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

Translational Medical Bioengineering

# Immunology and allergology

## Working program of basic discipline (Syllabus)

| Requisites for basic discipline | |
|---|---|
| **Level of higher education** | ***First (bachelor's)*** |
| **Field of knowledge** | ***16 Chemical and Bioengineering*** |
| **Specialty** | ***163 Biomedical Engineering*** |
| **Educational program** | ***Medical engineering*** |
| **Discipline status** | ***Selective discipline*** |
| **Form of study** | ***full-time / day / mixed / remote*** |
| **Year of preparation, semester** | ***3th course, autumn semester*** |
| **Course volume** | ***4 ECTS credits / 120 hours*** |
| **Semester control / Control measures** | ***Test / modular test / essay*** |
| **Lessons schedule** | ***26 lecture hours and 28 hours of practical classes*** |
| **Language of instruction** | ***English, Ukrainian*** |
| **Information about course leader / teachers** | ***Lecturer: Associate Professor, Bespalova Olena***<br>*http://bi.fbmi.kpi.ua/uk/bespalovaua/, o.bespalova@kpi.ua*<br>***Practical: Associate Professor, Bespalova Olena***<br>*http://bi.fbmi.kpi.ua/uk/bespalovaua/, o.bespalova@kpi.ua* |
| **Course placement** | ***https://do.ipo.kpi.ua*** |

## Program educational disciplines

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

**What will be studied**. The academic discipline "Immunology and Allergology" studies the structure and organization of the organs of the immune system, processes associated with differentiation, proliferation and programmed cell death, with the structural organization and functioning of macromolecules in lymphocytes, with the mechanisms of intercellular and intracellular signaling. Hypo-, hyper- and normal sensitivity in the immune response. Features of pathological processes involving immune mechanisms. Mechanisms of the development of allergic reactions of the body

**Why is it interesting/needs to study**

The study of the body's protective factors: natural barriers to infection (skin and mucous membranes, secretions, natural microflora), factors of nonspecific and specific resistance will allow you to acquire theoretical knowledge of the basics of immunology and be able to use them in practical activities, to develop and improve existing methods for diagnosing diseases in the pathogenesis of which immune mechanisms are involved.

**What can be learned**

• Knowledge: historical information about the development and formation of immunology as a science;
• general characteristics of the body's protective factors: natural barriers to infection (skin and mucous membranes, secretions, natural microflora);
- cellular factors of nonspecific resistance;
• humoral factors of nonspecific resistance: complement, acute phase proteins, cytotoxic factors, natural immunoglobulins, kinins;
• adaptive specific immunity, immune memory;
- the main cells of the immune system;
- the structural structure of antibodies, antigens;
- the mechanism of allergic reactions.

Ability to:

• distinguish the main structural and functional elements of the immune system at the organ and cellular levels;
• possess the basics of immunological research methodology;
• identify immune system cells using immunological methods;
• determine the functional activity of immunocompetent cells;
• investigate antibody levels using the enzyme-linked immunosorbent assay;
• distinguish immediate-type hypersensitivity from delayed-type hypersensitivity;
• determine the functional activity of phagocytic cells.

**How to use the acquired knowledge and skills**.

The acquired knowledge and skills are an important tool in conducting research and organizational and production work in the field of regenerative and biopharmaceutical engineering, biotechnology and biomedical engineering.

**Program competencies that must be formed after studying the discipline and that correspond to the educational program "Medical Engineering":**

*General competencies (EP put into effect by the Order of the Rector NON/434/2024 dated June 10, 2024)*

GC – **02** Knowledge and understanding of the subject area and understanding

*Special (professional) competencies (EP put into effect by the Order of the Rector NON/434/2024 dated June 10, 2024):*

**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 - 09-** Ability to identify, formulate, and solve engineering problems related to the interaction between living and non-living systems

*The program learning outcomes after studying the discipline "* Human Anatomy and Physiology. Part 1. Fundamentals of Biomedical Knowledge. Medical Terminology *" are (EP put into effect by the Order of the Rector NON/434/2024 dated June 10, 2024):*

PLO **-09-** Understand theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and materials for medical purposes

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

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

The study of the discipline "Immunology and Allergology" is preceded by the mastery of the academic disciplines: anatomy, biology. The academic discipline belongs to the cycle of elective academic disciplines, according to the structural and logical scheme of the specialist training program, the discipline "Immunology and Allergology" is closely related to the discipline of general training: "Human Anatomy and Physiology-2. Fundamentals of Human Anatomy and Physiology"

## 3. Content of the academic discipline

**Lecture topics*:***

1. Immunology as a science, the evolution of the immune system, theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects.
2. Structural and functional organization of the immune system, patterns of functioning of biological objects.
3. Properties and functions of immune system cells and patterns of functioning of biological objects.
4. Complement system, application of artificial biological and biotechnical objects.
5. General structure of antibodies, theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects.
6. Molecular structure and biological properties of antigens. biological and biotechnical objects.
7. Cytokines, understanding the fundamental and applied laws of functioning of biological objects.
8. Allergology, understanding the fundamental and applied laws of the functioning of biological objects

**Topics of practical classes**:

Practical work 1. Biosafety when working with biological material
Practical work 2. Central and peripheral organs of the immune system, structure, functions.
Practical work 3. Cells of the immune system
Practical work 4. Cellular factors of nonspecific resistance
Practical work 5. Adaptive immunity. T- and B-lymphocytes
Practical work 6. Nonspecific factors of the body's defense
Practical work 7. Structure and functions of immunoglobulins.
Practical work 8. Methods of immunological research. Enzyme immunoassay
Practical work 9. Antigens, their characteristics.
Practical work 10. Major histocompatibility complex.
Practical work 11 Biological significance of cytokines. Determination of tumor necrosis factor
Practical work 12. Allergic reactions, main methods of their determination
Practical work 13. Modular control work
Practical work 14. Final work

## 4. Training materials and resources

***Basic literature:***

1. Імунологія та алергологія. Навчальний посібник для самостійної роботи студентів спеціальності 163 «Біомедична інженерія» [Електронний ресурс]: навчальний посібник для студ. спеціальності 163 «Біомедична інженерія» / КПІ ім. Ігоря Сікорського: уклад. О.Я. Беспалова. - Електронні текстові дані (1 файл: 1,38 Мбайт). – Київ : КПІ ім. Ігоря Сікорського, 2021. – 51 с.

2.

2. Імунологія та алергологія. Навчальний посібник для практичних робіт з дисципліни «Імунологія та алергологія» [Електронний ресурс]: практикум: навч. посіб. для здобувачів ступеня

бакалавра за освіт. програмою «Медична інженерія» «Регенеративна та біофармацевтична інженерія» спец. 163 «Біомедична інженерія» / КПІ ім. Ігоря Сікорського ; уклад.: О.Я. Беспалова. – Електрон. текст. дані (1 файл 4,88 Мбайт). – Київ : КПІ ім. Ігоря Сікорського, 2025. – 85 с.

3. Клінічна імунологія та алергологія: навчальний посібник (ВНЗ III—IV р. а.) / В.В. Чоп'як, Г.О. Потьомкіна, А.М. Гаврилюк та ін.- Медицина, 2017.- 254 с.

4. Імунологічні методи : метод. вказівки до проведення лаб. занять з курсу «Імунологія» / Т. О. Філіпова, Т. В. Гудзенко, М. Б. Галкін, О. Ю. Зінченко, Г. В. Ямборко, М. Ю. Русакова. – Одеса : Одес. нац. ун-т ім. І. І. Мечникова, 2018. – 90 с.

5. Імунологія : навчально-методичний посібник/укл. Волощук О.М. – Чернівці : Чернівецький національний університет, 2021. – 128 с.

***Additional literature:***

1. Скок М.В. Основи імунології. – Київ: Фітосоціологічний центр, 2002. – 151 с. [Електрон. ресурс].

2. Вершигора А.Ю., Пастер Є.У., Колибо Д.В., Позур В.К., Віхоть М.Є., Михальський Л.О., Швець Ю.В., Холодна Л.С., Моложава О.С. Імунологія /За заг. ред. Є.У.Пастер/. – Київ: Вища школа, 2005. – 599 с.

3. Якобисяк М. Імунологія / Пер. з польської за ред. проф. В.В. Чоп'як. – Вінниця: Нова книга, 2004. – 672 с.

4. Janeway C.A., Travers P., Walport M., Shlomchik M. Immunobiology. 5th ed.- New York and London: Garland Publishing.- 2001.- 732 p.

5. Імунологія: підручник / Л.В.Кузнецова, В.Д.Бабаджан, Н.В.Харченко та ін.; за ред. Л.В.Кузнецова, В.Д.Бабаджан, Н.В.Харченко. –Вінниця: ТОВ «Меркьюрі Поділля», 2013.- с.565

## Educational content

### 5. Methods of mastering the discipline (educational component)

| № s/n | Lecture topics | Program learning outcomes | Main tasks | |
|---|---|---|---|---|
| | | | Control measure | Term implementation |
| 1. | Immunology as a science, the evolution of the immune system, theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects. | PLO 09 | Practical work 1, | 1 nd week |
| 2. | Structural and functional organization of the immune system, patterns of functioning of biological objects. | PLO 18 | Practical work 2 | 2- nd week |
| 3. | Properties and functions of immune system cells and patterns of functioning of biological objects.<br>Part 1. The main populations of cells of the immune system;<br>Part 2. Cellular factors of nonspecific resistance Part 3<br>Properties and functions of cells of specific immunity | PLO 18 | Practical work 3,4,5 | 3-4-5- nd week |
| 4. | Complement system, application of artificial biological and biotechnical objects. | PLO 09 | Practical work 6 | 6-- nd week |
| 5. | General structure of antibodies, theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects..<br>Part 1 Structural and functional organization of | PLO 09 | Practical work 7,8 | 7-8- nd week |

| № s/n | Lecture topics | Program learning outcomes | Main tasks | |
|---|---|---|---|---|
| | | | Control measure | Term implementation |
| | antibodies.<br>Part 2 Application of antibodies in biology and medicine | | | |
| *6.* | Molecular structure and biological properties of antigens. biological and biotechnical objects..<br>Part 1 Structural and functional organization of antigens.<br>Part 2 Antigens of the major histocompatibility complex | PLO *09* | Practical work *9,10* | *9-10-* nd week |
| *7.* | Cytokines, understanding the fundamental and applied laws of functioning of biological objects. | PLO *18* | Practical work *11* | *11-* nd week |
| *8.* | Allergology understanding of fundamental and applied laws of functioning of biological objects. Part 1 General etiology of allergic diseases. Classification of allergens and their Characteristics. Part 2 Immunopathological aspects of allergic reactions | PLO *18* | Practical work *12* | *12-* nd week |
| *9.* | Modular test work | PLO *18* | Practical work *13* | *13-* nd week |
| *10.* | Credit work | | Practical work *14* | *14-* nd week |
| | | | | |

**Topics of practical classes:**

Practical work 1. Biosafety when working with biological material.

*Structure of the immunological laboratory Get acquainted with the rules for working with a biological object. Structure of the immunological laboratory and its equipment. Research methods used in the immunological laboratory.*

Practical work 2. Central and peripheral organs of the immune system, structure, functions.

*Central organs of the immune system, structure, functions: thymus, red bone marrow; peripheral organs of the immune system: lymph nodes, spleen*

Practical work 3. Cells of the immune system

*Learn the main cells of the immune system, ontogenesis of B and T lymphocytes. Migration of T and B lymphocytes to peripheral lymphoid organs*

Practical work 4. Cellular factors of nonspecific resistance

*Learn the main cells of nonspecific immune protection. Determination of the leukocyte formula*

Practical work 5. Adaptive immunity. T and B lymphocytes

*Learn subpopulations of lymphocytes of adaptive immunity. Obtaining lymphoconcentrate in a density gradient of ficol-verografin*

Practical work 6. Nonspecific factors of the body's defense

*Get acquainted with the main cellular and humoral mechanisms of innate immunity (phagocytosis, complement,). Phagocytosis, types of phagocytic cells. Stages of phagocytosis. Completed and incomplete phagocytosis Complement, its properties, activation pathways. Learn methods for assessing factors of innate immunity of the human body.*

Practical work 7. Structure and functions of immunoglobulins.

*To learn the basic properties of immunoglobulins. Stages of antibody synthesis. Valence, affinity, avidity of antibodies. Interaction of antibodies with antigens.*

Practical work 8. Methods of immunological research.

*Enzyme immunoassay To learn the basic principles of non-competitive and competitive immunoassays using the example of enzyme-linked immunosorbent assay (ELISA).*

Practical work 9. Antigens, their characteristics.

*To learn the basic properties of antigens Complete and incomplete antigens. Autoantigens. Group antigens of human erythrocytes. To get acquainted with the reactions of determining blood groups (AB0 system) using monoclonal antibodies and standard sera.*

Practical work 10. Major histocompatibility complex.

*To learn the structure of MHC I, II genes and their main functions*

Practical work 11 Biological significance of cytokines.

*Determination of tumor necrosis factor To learn the main biological properties of cytokines. To get acquainted with the method of determining cytokines using the example of tumor necrosis factor alpha.*

Practical work 12. Allergic reactions.

*To learn the main types of allergic reactions, methods of their diagnosis*

Practical work 13. Modular control work

Practical work 14. Final work

## 6. Independent work student

The total amount of independent work within the discipline is 66 hours, including:

- Study of theoretical material - 26
- preparation for practical classes – 24 hours;
- preparation for modular test (MCT) – 4 hours;
- preparation of abstract work – 6 hours.
- preparation for the test – 6 hours

An individual assignment in the form of an essay is planned for the discipline "Immunology and Allergology". The main goal of the essay is to deepen and expand students' theoretical knowledge on individual topics of the academic discipline, to gain experience in independent work with educational and scientific literature. The essay is completed in accordance with the requirements, within the time specified by the teacher.

**Approximate topics of abstracts**

1. Structure and functions of immunoglobulins of animals of the genus Bos taurus
2. Biomarkers of healing: prognostic, diagnostic, indicative. Cellular and molecular markers.
3. Molecular and cellular mechanisms that inhibit wound healing.
4. Skin as an organ of the immune system. Immunocompetent skin cells.
5. Physical, chemical and biological factors of skin protection.
6. Skin microbiome: bacteria, fungi, viruses.
7. Immune interaction of commensal microorganisms and the immune system.
8. Types of wounds and physiological bases of their healing.
9. The role of the immune system in wound healing in normal and in various infectious and non-infectious pathologies.
10. The role of microbiota in wound healing. Chronic wounds and personalized medicine
11. Nonspecific resistance of the organism. The complement system and its functions.
12. Structure and functions of primary and secondary lymphoid organs.
13. Stem cells of the hematopoietic system and their applied significance.
14. T-lymphocytes, B-lymphocytes and their functions. CD-markers of immune system cells and their functional significance.
15. The role of macrophages in the regulation of immune reactions. The role of dendritic cells in antigen presentation.
16. Features of the structure and function of antibodies of different classes.
17. The role of the major histocompatibility complex in the recognition of self and foreign. Features of the structure and function of MHC I and MHC II molecules.
18. Cytokines and cytokine cascade. 10. Monoclonal antibodies.

19. Mechanisms of formation of central and peripheral immune tolerance.
20. Molecular genetic mechanisms of transplant rejection.
21. Antigens. Molecular structure and biological properties.
22. Allergy classification, causes.
23. Immediate and delayed hypersensitivity, mechanisms of occurrence.
24. Immunopathological aspects of allergic reactions. Stages of development, allergic reactions
25. Enzyme-linked immunosorbent assay and its practical significance.
26. Flow immunocytometry. Principles and practical significance of the method.
27. What is the major histocompatibility complex. What is the main function of this complex.
28. Reactions with labeled antibodies or antigens. Principles and practical use of immunofluorescence reactions (IFR).
29. The role of various cells of the body in the development of allergic reactions: eosinophils, neutrophils, platelets, basophils.
30. Complement system, activation pathways.
31. Interferons and their role in the immune response.

The title page of the abstract should have the following content: name of the university; name of the faculty; name of the department; name of the academic discipline; topic of the abstract; level of higher education, name of the specialty, name of the educational and professional program, surname and first name of the student, course, academic group number, year.

The title page is followed by a detailed plan (table of contents) of the abstract, which should include the introduction, sections of the main content, their subdivisions (if necessary), conclusion, and a list of sources used. The table of contents indicates the page numbers of the beginning of each structural element on the right.

The introduction justifies the relevance of the chosen topic, assesses the state of research on the problem, formulates the goal and defines the tasks of the essay, and provides a brief overview of the available literature and sources used.

The main part includes an analytical review of modern sources (at least 5) and a generalization of information on a given topic.

The abstract is written in an impersonal style (considered, analyzed, proven, etc.). The presentation of the material should be clear, specific, and accompanied by the necessary explanations with references to sources of information

References should be indicated by a sequential number following the list of sources used in square brackets, for example, "…in the collection of tasks [3, p.34]...».

The conclusion should cover the following aspects:
− assess the degree of achievement of the goal and fulfillment of the tasks of the work;
− list and briefly describe known approaches to the problem under consideration;
− highlight new aspects that are subject to further study;
− determine what is valuable in the abstracted works and requires additional analysis.

The list of sources used is drawn up in accordance with 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 website address.

The abstract must be printed on a standard A4 sheet of paper, observing the following requirements: left margin – 30 mm, right – 15 mm, top – 20 mm, bottom – 20 mm; Times New Roman font size 14 pt; line spacing – 1.5; red line indentation – 1.25; text alignment – widthwise.

There are no requirements for the length of the abstract. The length should be such that it fully reveals the essence of the topic and contains all the necessary structural elements. It is recommended to be no less than 10 and no more than 25 pages.

Each structural element of the work's content begins on a new page. The names of structural elements should be placed in the center of the line without a period at the end, without underlining, separated from the text by three line spacings. Hyphenation in words is not used. Figures and tables should have headings and numbering consistent with the section number.

The abstract is evaluated according to the following criteria:
− Relevance to the chosen topic;

− Quality of design and presence of all necessary structural elements;
− Originality of the submitted material;
− Degree of mastery of the theoretical material presented in the abstract.

The deadline for submitting an essay for evaluation is the 14th week of study.

Essays are not checked for plagiarism, but must meet the requirements of academic integrity. If academic dishonesty is detected, the work will not be credited.

## Policy and control

### 7. Policy educational disciplines (educational component)

**Violation of task deadlines and incentive points**

Applicants may be awarded incentive points. The total amount of incentive points cannot exceed 5 points.

Incentive points are awarded for the following activities:

- participation in international or all-Ukrainian scientific conferences, congresses, etc. (on the subject of the academic discipline) (subject to publication of abstracts) (5 points;

**Attending classes**

No penalty points are awarded for absence from classes. However, applicants are encouraged to attend classes, as they teach theoretical material and develop practical skills necessary for the thorough formation of relevant competencies.

The assessment system is focused on receiving points for student activity, as well as completing tasks that can develop practical skills and abilities.

**Missed assessment controls**

Assessment tests scheduled to be administered during class are conducted on a pre-determined day, which is announced to students during the first week of the educational process. Conducting such assessment tests on another day is permitted in cases of serious and/or force majeure circumstances.

A practical assignment submitted for verification after the deadline, but before the deadline for issuing the current certification (or test/exam), is evaluated with penalty points.

Missing express control (tests) are not processed.

The result of the module test for an applicant who did not appear for the test is zero. In this case, the applicant has the opportunity to complete the module test at another time in agreement with the teacher.

**Ensuring objectivity in assessing applicants**

The objectivity of assessing applicants at all stages of mastering the discipline is ensured through the following mechanisms. First, the use of test forms for assessing knowledge. Second, detailed recommendations on the rating system for assessing learning outcomes (Section 8 of the Syllabus). Third, the use by applicants and teachers of all possible communication tools that ensure the preservation of communication history (e-mail, social networks, messengers, etc.). Fourthly, in case of disagreement with the assessment results, another teacher with appropriate professional competence and appointed by the department for the current academic year may be involved in checking the written works of applicants. In the absence of a coordinated opinion of the teachers regarding the assessment of the applicant's work, the issue is brought to a meeting of the department, and the issue is resolved in accordance with the "Regulations on Appeals at Igor Sikorsky Kyiv Polytechnic Institute" http://osvita.kpi.ua/node/182.

**Procedure for appealing the results of assessment control measures**

After receiving comments from the teacher with arguments regarding the assessment, the applicant has the right to individually ask all questions of interest regarding the results of the assessment control measures. If the applicant disagrees with the assessment, he must also provide arguments for his position and contact the dean of the faculty for further resolution of the issue (for details, see "Regulations on Appeals at Igor Sikorsky Kyiv Polytechnic Institute" http://osvita.kpi.ua/node/182).

**Academic integrity**

When using copyrighted content, analytical research results, and/or other information, applicants must cite the source. 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" (https://kpi.ua/code ). In the event of a need to check academic texts prepared for applicants for the presence of text borrowings, the applicant may contact the teacher or the responsible person of the department for checking academic texts.

**Norms of ethical behavior**

The norms of ethical behavior of applicants and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (https://kpi.ua/code).

**Distance learning**

Distance learning takes place through the Sikorsky Distance Learning Platform.

Online courses are provided in case of force majeure circumstances (in particular, quarantine measures) and for inclusive education of applicants with special needs.

**Inclusive learning**

The academic discipline is designed for students with special educational needs, but it should be taken into account that it places a heavy load on the visual apparatus. Depending on the special needs of students, distance learning may be used.

## 8. Types control and rating system evaluation results teaching (ERT)

**Current control**.

Work on lectures, practical classes involves express surveys. Answering 1 question in an express survey has a weighted score of -2.0

The maximum number of points on 4 express surveys is 2.0 points x 4 = 8 points.

Criteria for evaluating answers to questions in an expert survey*:*

| | |
|---|---|
| The question is fully answered. | 2,0- points. |
| The question is partially answered, contains minor inaccuracies | 1,0-1,5 points. |
| The question is partially answered, contains significant inaccuracies | 0,5- 1,0 points. |
| The question is not resolved. | 0- points. |

*Work in practical classes involves*:

• completion of a practical task weighted score – 3. The practical task consists of three questions. The maximum number of points for 12 practical classes is 3 points x 12 = 36 points.

Criteria for evaluating the answer to the question to the practical task:

| | |
|---|---|
| The question is fully answered. | 1- points. |

| | |
|---|---|
| The question is partially answered. | 0,5- points. |
| The question is not resolved. | 0- points. |

- completing a test task containing 10 questions with 0.5 points for the correct answer is equal to 5 points. There are 5 tests x 5 points = 25 points.
- *Modular control work* (MCR) is carried out in the form of a test, which is evaluated at 20 points. Tests for MCR consist of 40 questions with 0.5 points for the correct answer.
- *Abstract work is evaluated* at 11 points

Essay evaluation criteria.

| | |
|---|---|
| « Excellent", all work requirements met | 11- points. |
| « "Good", all work requirements are met, or there are minor errors | 10-7 points. |
| « Satisfactory", there are shortcomings in fulfilling the work requirements and certain errors | 6-3 points. |
| « Unsatisfactory", the work is not submitted or does not meet the requirements for "Satisfactory" | 0 points. |

**Calendar control**: is carried out twice a semester as a monitoring of the current status of implementation of the syllabus requirements. The first calendar control involves the performance of practical work No. 1-3, test No. 1-2, the second calendar control involves the performance of practical work No. 4-10, test tasks No. 3-5, abstract work.
**Maximum semester rating of the applicant**: 100 points

The sum of the weighted points of control measures during the semester is:

**R c= 8+36+25+20+ 11= 100** points.

**Semester control:** credit.

**The conditions for admission** to the test are the acceptance of the abstract paper; defense of all practical papers, writing an MCR of at least 15 points, as well as a starting rating (rc) of at least 40% of the $R_C$, i.e. **40** points.

In case of a semester rating of 60 points or higher, the applicant can receive a credit automatically. In case of disagreement or a rating of less than 60 points, students perform a credit test.

Table of correspondence of rating scores to university scale grades:

| Number of points | Rating |
|---|---|
| 100-95 | *Perfect* |
| 94-85 | *Very good* |
| 84-75 | *Good* |
| 74-65 | *Satisfactorily* |
| 64-60 | *Enough* |
| <60 | *Unsatisfactorily* |
| *Admission conditions are not met* | *Not allowed* |

## 9. Additional information with disciplines (educational component)

*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 "Immunology and Allergology y".

*Appendix 2. Questions submitted for semester control.*

Correspond to the topics of lectures and practical classes. Recognition of learning outcomes acquired in non-formal/informal education is carried out in accordance with the "Temporary Regulation on the Procedure for Recognition of Learning Outcomes Acquired by Students of Igor Sikorsky Kyiv Polytechnic Institute in Non-formal/Informal Education" (https://osvita.kpi.ua/node/119).

**Working program educational disciplines (syllabus):**
**Compiled** Candidate of Biological Sciences, Bespalova O. Ya.
**Approved** by the Department of Translational Medical Bioengineering (protocol No. 14 from 06.06.2024)
**Approved** by methodical by the commission faculty BME (protocol No. 9 from 26.06.2024)

Appendix 1
to the syllabus discipline
" Immunology and Allergology"

**Program learning outcomes (extended form)**

As a result of studying the academic discipline " Immunology and Allergology ", students will be able to:

| **Learning outcomes** | | Relevance of learning outcomes to competencies in the educational and professional program [1] | |
|---|---|---|---|
| | | **General Competence (soft skills)** | **Special competence (professional)** |
| PLO 09 | Understand theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and materials for medical purposes | GC 2 - Knowledge and understanding of the subject area and understanding | - **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.) |
| 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 | GC 2 - Knowledge and understanding of the subject area and understanding | PC 09- Ability to identify, formulate, and solve engineering problems related to the interaction between living and non-living systems - |

[1] 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
to the syllabus discipline
" Immunology and Allergology"

**List of questions submitted for semester control**

1.What does immunology study?
2. What are the factors of nonspecific defense of the body?
3. Advantages and disadvantages of nonspecific resistance mechanisms.
4. Phagocytosis. Cells capable of phagocytosis. Types of phagocytosis.
5. How does phagocytosis occur?
6. Complement, its components. What are the similarities and differences between the two ways of complement activation? What are the methods of its determination?
7. Properdin system. What is its nature, properties and significance?
8. What is lysozyme; its nature?
9. How does lysozyme act on microorganisms? What are the methods of its determination?
10. Define the concept of "cytokines". Their immunomodulatory and protective action.
11. What are interferons? Name the main varieties, what is their role in antiviral, antitumor defense and immunomodulatory function of the body?
12. What is the practical significance of determining complement, lysozyme, phagocytosis and other indicators of nonspecific protection of the body?
13. What organs of the immune system are central and peripheral, their functions?
14. What cells are immunocompetent, their functions?
15. What cells participate in the synthesis of antibodies, the nature of their cooperation?
16. Define the concepts: antigens, antigenicity.
17. Structure and functions of immunoglobulins.
18. The role of genetic factors and the environment in the immunopathogenesis of allergy.
19. Modern ideas about allergy and atopy. Atopy as a systemic disease.
20. Types and main stages of immunological reactions.
21. Modern aspects of allergy diagnostics.
22. Screening methods in the assessment of allergy.
23. Elimination and provocative tests in allergology. 24. Types of skin tests.