**SYLLABUS**

**Fall semester 2024-2025 academic year**

**Educational program *6B05103 Биотехнология НИШ, дневная,***

***3 course (Autumn)***

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| **ID**  **and name**  **of course** | **Independent work**  **of the student**  **(IWS)** | | **Number of credits** | | | **General**  **number**  **of credits** | **Independent work**  **of the student**  **under the guidance**  **of a teacher (IWST)** |
| **Lectures (L)** | **Practical classes (PC)** | **Lab. classes (LC)** |
| Bioprocesses Engineering | The number of IWS is 5. | | 3 | 6 |  |  | The number of  IWST is 3.  This is a teacher's guide.  for the preparation of the IWS. |
| **ACADEMIC INFORMATION ABOUT THE COURSE** | | | | | | | |
| **Learning Format** | **Cycle,**  **component** | **Lecture**  **types** | | **Types**  **of practical classes** | | **Form and platform final control** | |
| *Choose*  *Offline/online/*  *hybrid* | Selectable Component | Offline | | Offline | | Univer standart | |
| **Lecturer - (s)** | Kenzhebayeva Saule Sagindykovna | | | | |
| **e-mail :** | [Saule.Kenzhabaeva@kaznu.edu.kz](mailto:Saule.Kenzhabaeva@kaznu.edu.kz) | | | | |
| **Phone :** |  | | | | |
| **Assistant - (s)** |  | | | | |
| **e-mail :** |  | | | | |
| **Phone :** |  | | | | |
| **ACADEMIC COURSE PRESENTATION**  . | | | | | | | |
| **Purpose**  **of the course** | **Expected Learning Outcomes (LO) \*** | | | | | **Indicators of LO achievement (ID)** | |
| To acquaint students with the some of the experimental and theoretical tools available that help identify and optimize bioengineering processes at the various level of organization of living organisms. | * 1. To demonstrate knowledge about types of b**ioprocess technology-** A technique that produces a biological material * industrial microbiology/ biotechnology**-** deals with all forms of microbiology and biotechnology which have an economic aspect. * fermentation technology**-** deals with process and techniques involved in fermentation, in which a substance breaks down to simpler ones. Main products obtained throught fermentation; * biochemical engineering**-** is a field of study which involves both chemical engineering and biological engineering. * Some of the specific subfields of biological engineering includes molecular engineering, soil and water engineering, physiological engineering, controlled-environment agriculture, nucleic acid engineering, microbial fuel cells, strength structures engineering, cell and tissue engineering, and bioenergetics and strain factors. * Variousproducts of Industrial biotechnology**:**   Tools of Industrial biotechnology: Genetic Engineering  Protein Engineering  Metabolic Engineering  New developments in Synthetic biology  System biology- Omics and *inSilico* Approaches | | | | | * 1.1. know the types of bioprocess technology - atechnique that produces a biological material; * 1.2. analyze the important functions and forms of industrial microbiology/ biotechnology which have an economic aspect.   1.3. finds a correspondence between the properties of compounds and their biological functions to develop needed products;  1.4. demonstrates knowledge of the most important metabolic processes of a living organism  1.5 understand some of the specific subfields of biological engineering includes metabolic engineering, cell and tissue engineering, physiological engineering, controlled-environment agriculture, nucleic acid engineering, microbial fuel cells, strength structures engineering, soil and water engineering, and bioenergetics and strain factors   * 1.6. based on lecture material and information sources, can write Variousproducts of Industrial biotechnology**:**   Tools of Industrial biotechnology: Genetic Engineering  Protein Engineering  Metabolic Engineering  New developments in Synthetic biology  System biology- Omics and *inSilico* approaches,  ,describe the mechanism of their cellular, biochemical and metabolic processeson a living organism | |
|  | |
| 2. to choose and apply in practice modern methods of biochemical and physiological research for the qualitative and quantitative analysis of biological material; and apply the basic methods used in various fields of bioprocesses engineering | | | | | 2.1. conducts information search to solve research problems;  2.2. formulates research objectives and plans the process of its implementation; prepares equipment (instruments, apparatus) for conducting experiments;  2.3. selects and prepares samples (biological material) for the experiment;  2.4. conducts a qualitative and quantitative analysis of biological material, according to methodological recommendations in accordance with safety regulations; | |
| 3. to interpret the results of biochemical and physiological experiments, evaluating the relationship between the structure of biomolecules and their physiological functions at the molecular level; interpret and analyze the results while conducting experiments with the variious organisms, contextualize the various approaches and methods used in bioprocesses Engineering | | | | | 3.1. fixes and draws up the results of experimental work in the required format (tables, graphs, diagrams, etc.)  3.2. evaluates the correctness of the laboratory test;  3.3. analyzes the data obtained during the experiment;  3.4. compares the obtained data with the expected results, confirming the correctness of the experiment; | |
| 3.5. makes final conclusions from the data obtained; | |
| 4. to demonstrate knowledge of the specialization of bioprocesses engineering such as biological engineering, biotechnology, cell engineering, genetic and metabolic engineering, chemical engineering and agricultural engineering; describe the schemes used to characterize the basic processes of these specialization; | | | | |  | |
| 4.24.1 explain the essence of the main processes of plant cells and their interaction, formulate conclusions obtained as a result of experiments, argue a different approach to the study | |
| 5. analyze the features of the shape or style and development of equipment and processes for the creation of products of Pharmaceuticals   1. Nutraceuticals 2. Food 3. Feed 4. Chemical 5. Paper 6. And many polymer from biological materials. | | | | | 5.1. explain the processes for the creation of ecomonically valuable products of pharmaceuticals, food, feed and other important products;  5.2 demonstrate theoretical knowledge and practical skills in cell engineering, genetic and metabolic engineering, show knowledge of their application and techniques for imporing and developing new products. | |
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| **Prerequisites** | Plant anatomy and morphology, Cytology and histology, Plants physiology | | | | | | |
| **Postrequisites** | Regulation of physiological processes of plants productivity, Agronomy, Agriculture | | | | | | |
| **Learning Resources** | **Literature:** main,   1. Principles of fermentation technology, Stanbury,P.F and Whitaker 2. Advances in Industrial Biotechnology, Chapter: 1 Industrial Biotechnology: An Overview, I. K. International Publishingh House Pvt. Ltd., New Delhi, Banglore, India Eds: Ram Sarup Singh, Ashok Pndey, Christian Larroche 3. Bioprocess technology, fundamentals and applications, KTH, Stockholm. 2019. 4. Biomaterials for Tissue Engineering Applications: A Review of the Past and Future Trends - By Robert L. Mauck.2020. 5. Biomaterials: An Introduction - By Roderic S. Lakes; 2020, 6. Biomaterials and Tissue Engineering - by Donglu Shu, 2019. 7. Pogaku Ravindra (13 Aug 2015). [*Advances in Bioprocess Technology*](https://books.google.com/books?id=Y4RgCgAAQBAJ&pg=PA428). Springer. p. 424.   **Additional:**  Kristiina Himanen (2015). Cell cycle regulation during plant growth and development, Jörg D. Becker (2012) Decision- Making in the Plant Cell Cycle.Canal BQ-n.9.  Atkin OK, Bloomfield KJ, Reich PB, et al. (2015) Global variability in leaf respiration in relation to climate, plant functional types and leaf traits. New Phytologist 2016: 614–636.  Kim, Yu Seon; Smoak, Mollie M.; Melchiorri, Anthony J.; Mikos, Antonios G. (1 January 2019). ["An Overview of the Tissue Engineering Market in the United States from 2011 to 2018"](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6352506). *Tissue Engineering. Part A*. **25** (1–2): 1–8.  Malek-Khatabi, A.; Javar, H.A.; Dashtimoghadam, E.; Ansari, S.; Hasani-Sadrabadi, M.M.; Moshaverinia, A. (2020). ["In situ bone tissue engineering using gene delivery nanocomplexes"](https://pubmed.ncbi.nlm.nih.gov/32160962). *Acta Biomaterialia*. **108**: 326–336  **Research infrastructure**  1. Laboratories and other locations where teaching and learning will take place  2.  **Professional scientific databases**  1.  2 **.**  **Internet resources** (at least 3-5)  <https://unacademy.com/lesson/introduction-to-bioprocess-engineering/2VOHJWDZ>  [www.youtube.com](http://www.youtube.com/)  <http://bioprocessint.com/manufacturing/continuesbioprocessing>  *https:www.*chemengonline.com/industrial-microorganisms/  [*http://www*](http://www)*.* slideshare.net/MRakibulIslam/industrial-microorganisms  **Software** (optionally) | | | | | | |

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| **Academic**  **course policy** | | The academic policy of the course is determined by [the Academic Policy](https://univer.kaznu.kz/Content/instructions/%D0%90%D0%BA%D0%B0%D0%B4%D0%B5%D0%BC%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B0%D1%8F%20%D0%BF%D0%BE%D0%BB%D0%B8%D1%82%D0%B8%D0%BA%D0%B0.pdf) and [the Policy of Academic Integrity of Al-Farabi Kazakh National University .](https://univer.kaznu.kz/Content/instructions/%D0%9F%D0%BE%D0%BB%D0%B8%D1%82%D0%B8%D0%BA%D0%B0%20%D0%B0%D0%BA%D0%B0%D0%B4%D0%B5%D0%BC%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%BE%D0%B9%20%D1%87%D0%B5%D1%81%D1%82%D0%BD%D0%BE%D1%81%D1%82%D0%B8.pdf)  Documents are available on the main page of IS Univer .  **Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions andassignments.  **Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points.  **Аcademic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable.  Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by [the "Rules for the final control"](https://univer.kaznu.kz/Content/instructions/%D0%9F%D1%80%D0%B0%D0%B2%D0%B8%D0%BB%D0%B0%20%D0%BF%D1%80%D0%BE%D0%B2%D0%B5%D0%B4%D0%B5%D0%BD%D0%B8%D1%8F%20%D0%B8%D1%82%D0%BE%D0%B3%D0%BE%D0%B2%D0%BE%D0%B3%D0%BE%20%D0%BA%D0%BE%D0%BD%D1%82%D1%80%D0%BE%D0%BB%D1%8F%20%D0%9B%D0%AD%D0%A1%202022-2023%20%D1%83%D1%87%D0%B3%D0%BE%D0%B4%20%D1%80%D1%83%D1%81%D1%8F%D0%B7%D1%8B%D0%BA%D0%B5.pdf) , ["Instructions for the final control of the autumn / spring semester of the current academic year"](https://univer.kaznu.kz/Content/instructions/%D0%98%D0%BD%D1%81%D1%82%D1%80%D1%83%D0%BA%D1%86%D0%B8%D1%8F%20%D0%B4%D0%BB%D1%8F%20%D0%B8%D1%82%D0%BE%D0%B3%D0%BE%D0%B2%D0%BE%D0%B3%D0%BE%20%D0%BA%D0%BE%D0%BD%D1%82%D1%80%D0%BE%D0%BB%D1%8F%20%D0%B2%D0%B5%D1%81%D0%B5%D0%BD%D0%BD%D0%B5%D0%B3%D0%BE%20%D1%81%D0%B5%D0%BC%D0%B5%D1%81%D1%82%D1%80%D0%B0%202022-2023.pdf) , "Regulations on checking students' text documents for borrowings".  Documents are available on the main page of IS Univer .  **Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life.  All students, especially those with disabilities, can receive counseling assistance by phone / e- mail [Saule.Kenzhabaeva@kaznu.edu.kz](mailto:Saule.Kenzhabaeva@kaznu.kz) *contacts* or via video link in MS Teams *enter a permanent link to the meeting.*  **Integration MOOC (massive open online course).** In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule.  **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points. | | | | |
| **INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT** | | | | | | |
| **Score-rating letter system of assessment of accounting for educational achievements** | | | | | **Assessment Methods** | |
| **Grade** | **Digital**  **equivalent**  **points** | | **points,**  **% content** | **Assessment according to the traditional system** | **Criteria-based assessment** is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.  **Formative assessment is** a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.  **Summative assessment** -type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course.Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated. | |
| A | 4.0 \_ | | 95-100 | Great |
| A- | 3.67 | | 90-94 |
| B+ | 3.33 | | 85-89 | Fine |
| B | 3.0 | | 80-84 | **Formative and summative assessment**  The teacher introduces his own types of assessment or uses the proposed option | **Points % content**  The teacher enters his score into points in accordance with the calendar (schedule).  The exam does not change  and the final score in the course. |
| B- | 2.67 | | 75-79 | Activity at lectures | 5 |
| C+ | 2.33 | | 70-74 | Work in practical classes | 20 |
| C | 2.0 | | 65-69 | Satisfactorily | Independent work | 25 |
| C- | 1.67 | | 60-64 | Design and creative activity | 10 |
| D+ | 1.33 | | 55-59 | Unsatisfactory | Final control (exam) | 40 |
| D | 1.0 | | 50-54 | TOTAL | 100 |
| **Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.** | | | | | | |

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| **A week** | **Topic name** | **Number of hours** | **Max.**  **ball** |
| ***MODULE 1*** *Physiological processes in on plants* | | | |
| **1** | **L 1.** Theme Introduction to bioprocesses. Overview of bioprocesses. History of bioprocesses. Current bioprocesses development, technology and main products. Introduction to bioprocesses engineering | **2** | **0** |
| **PW 1.** Main products of Bioprocesses Engineering: Biopolymer, Bio-sensors, Bio-chips, Bio-filters, Bio-pesticides, Concrete Self-heal | 4 | 10 |
| **L.2**. Fermentation. Biological role.Types of fermentation | **2** | **0** |
| **PC 2.** Theme Biochemistry of individual products of fermentation | 3 | 10 |
| **LC 2.** Theme | 2 | 10 |
| **IWS P 1.** Consultations on the implementation of **IWST 1**  ATTENTION. Number of IWST (6-7), IWS (2-5 ) for 15 weeks  Types of fermentation include mixed acid fermentation, butanediol fermentation,butyrate fermentation,caproate fermentation,acetone–butanol–ethanol fermentation, andglyoxylate fermentation. The batch fermentation process | **2** | **15** |
| **3** | **L 3.** Theme Phytofermentation. Modern "fermentation. Dark Fermentation. | **2** | **0** |
| **PC 3** ThemeUpstream processing in fermentation Scale up ofFermentation. |  |  |
| **LC 3.** | 1 | 10 |
| **IWST 2.** Control work, test, individual / group project, essay, situational task, testing, portfolio, etc. at the teacher's choice. | 2 | 15 |
| **4** | **L 4.** Theme. Microbial fuel cell. | 2 | 0 |
| **PC 4.** Theme. The types of microbial fuel cell. Mediated MFC. Mediator-free microbial fuel cells Microbial electrolysis. A soil-based MFC. Phototrophic biofilm. Nanoporous membrane. Applications in of MFC in environmental remediation. | 4 | 10 |
| **LC** 4. |  |  |
| **5** | **L 5.** Theme Industrial important microbes | 2 | 0 |
| **PC 5.** Theme Industrial important algae and fungi | 4 | 10 |
| **IWST3.** Theme. Applications of Bioprocessing. Fed-batch Fermentation. Continuous Fermentation. Optimising cell culture media. Isolating cell lines. Bioprocessing and the Fight Against Antibiotic Resistance. | 2 | 15 |
| *MODULE 2 Title. Various types engineering for developing new valuable products.* | | | |
| **6** | **L 6.** Theme. Microbial degradation of xenobiotics | 2 | 0 |
| **PC 6.** Theme. Fungal biodegradation. Cholesterol biodegradation. Analysis of waste biotreatment. Aerobic and anaerobic degradation of pollutants. | 4 | 10 |
| **LC 6.** Theme. |  |  |
| **IWST 4.** Consultations on the implementation of **IWS 2.**  Fermentation used at an industrial level to produce commodity chemicals. | 1 | 15 |
| **7** | **L 7.** Biological importance of a mold, (mould) - one of the structures that certain [fungi](https://en.wikipedia.org/wiki/Fungus) form. | 2 | 0 |
| **PC 7.** Theme. Common molds for harmaceuticals. Food production. **Midterm control 1** | 4 | 10 |
| **LC 7.** Theme |  |  |
| **IWST 5.** The taxonomically diverse number of fungal species that form molds.Texture of many molds. Mechanism of formation. Classification of molds. steps involved in process of genetic engineering. | 2 | 15 |
| **8** | **L 8.** Genetic Engineering, Techniques. Application | 2 | 0 |
| **PC 8.** Theme genetically modified organisms such fungi, viruses, plants, crops, animals, gene therapy and for bioremediation | 4 | 10 |
| **LC 8.** Theme. |  |  |
| **9** | **L 9.** Omics driven bioengineering.Metabolic engineering. | 2 | 0 |
| **PC9.** Theme. Plant Metabolic Engineering. Approaches to Plant Metabolic Engineering | 4 | 10 |
| **10** | **L.10.** Biochemical Engineering | 2 | 0 |
| **PC. 10.** Theme.Examples using **b**iochemical Engineering for developing products and processes. | 4 | 10 |
| **11** | **L.11.** Theme. Biomolecular enginering . | 2 | 0 |
| **PC. 11.** Theme. Biomolecular engineering for manipulation of carbohydrates, proteins, nucleic acids and lipids. | 4 | 10 |
| **IWST 6.** Theme. Algae biofuel. Use of algae for biogas, green diesel, food supplementation. Algae-based energy harvester. Species. The techniques used for inserting the isolated gene into the host genome. Recent advancements using genome editing techniques, notably CRISPR for , the production of GMOs. |  | 15 |
| **12** | **L.12.** Immobilization of enzymes and cells | 2 | 0 |
| **PC.12.** Examples usingimmobilization of enzymes and cells for improving products and processes proprties. | 4 | 10 |
| **13** | **L.13.** Biopreservation. Biopreservatives. Importance.Properites. Outcome. Classification chemical Engineering | 2 | 0 |
| **PC. 13.** Antioxidants. Nonsynthetic compounds for food preservation. Traditional techniques  for food preservation | 4 | 10 |
| **14** | **L. 14.** Cell Engineering | 2 | 0 |
| **PC. 14.** Cell Engineering for adjustment of cell properties, augmenting cells to produce new products. Examples of application cell **e**ngineering for these purposes. | 4 | 10 |
| **15** | **L. 15.** Tissue engineering | 2 | 0 |
| PC. 15. Examples for tissue engineering. Bioartificial organs. Stem cells. **Midterm control 2** | 4 | 20 |
| **Midterm control 2** | | | **100** |

**Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kurmanbayeva M.S.**

**Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kistaybayeva A.S.**

**Lecturer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kenzhebayeva S.S.**

**RUBRICTOR FOR CRITERIAL ASSESSMENT OF FINAL CONTROL**

**Discipline:** «Plants Physiology” **Form:** written exam, standard form, offline  **Platform:** IS Univer

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|  | **Criterion/score** | **Дескрипторы** | | | | |
|  | **Great** | **Fine** | **Satisfactorily** | **UnSatisfactorily** | |
| **№** | **90–100% (27-30 баллов)** | **70–89% (21-26 баллов)** | **50–69% (15-20 баллов)** | **25–49% (8-14 баллов)** | **0–24% (0-7 баллов)** |
| 1 question  3**3 scores** | Understanding the theoretical basis of Plants Physiology | The answer contains an exhaustive disclosure of the question, a detailed argumentation of each conclusion and statement, is built logically and consistently, supported by examples | The answer contains a full, but not exhaustive coverage of the issue, a shortened argumentation of the main provisions, allows violation of the logic and sequence of the presentation of the material. Stylistic errors and inaccurate use of terms are allowed in the response. | The answer contains incomplete coverage of the issue, the main provisions are superficially reasoned, violations of logic and sequence of presentation of the material are allowed in the presentation, theoretical provisions are not illustrated with practical examples | The answer contains incorrect coverage of the question posed, erroneous argumentation, factual errors, incorrect conclusions. | Ignorance of basic concepts.  Violation of the Rules of the final control |
| 2 question  3**3 scores** | Application of physiological methods to solve problems of productivity of agricultural pplants.  Based on specific examples, present regulations for physiological processes/or explain the use of specific methods and practical applications | Full completion of the task, a detailed, reasoned answer to the question, followed by the solution of a practical problem.  Consistent, logical and correct justification of scientific provisions and the applied methodology and technology, literacy, compliance with the norms of scientific language, 1-2 inaccuracies in the presentation of the material are allowed, which do not affect the conclusions that are generally correct, visualization of the results of the justification, if necessary. | Partial completion of the task, incomplete, sometimes reasoned answer to a question with an incomplete solution of a practical problem; illiterate use of the norms of scientific language.  3-4 inaccuracies in the use of conceptual material, minor errors in generalizations and conclusions that do not affect a good overall level of task performance are allowed. | The material is presented in fragments, with a violation of logical sequence, factual and semantic inaccuracies are allowed, theoretical knowledge of the course is used superficially.  Conclusions on the applicability of sound scientific provisions are vague and unconvincing, there are stylistic and grammatical errors, as well as inaccuracies in the processing of the results of a practical solution | An irrational method of solving a task or an insufficiently thought-out response plan; inability to solve tasks, perform tasks in general; assumption of more than 4 errors and shortcomings; the presence of gross errors; conceptual material and argumentation are poorly used. | The task has not been completed, there are no answers to the questions posed, materials and analysis tools have not been used.  Violation of the Rules of the final control. |

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|  | **Criterion/score** | **Дескрипторы** | | | | |
|  | **Great** | **Fine** | **Satisfactorily** | **UnSatisfactorily** | |
| **№** | **90–100% (36-40 баллов)** | **70–89% (35-28 баллов)** | **50–69% (27-20 баллов)** | **25–49% (19-10 баллов)** | **0–24% (0-9 баллов)** |
| 3 question  **34scores** | Analysis of the applicability of the key physiological methods to the proposed practical task, justification of the result obtained | Consistent, logical and correct justification of scientific positions and the applied methodology and technology, literacy, compliance with the norms of scientific language, 1-2 inaccuracies in the presentation of the material are allowed, which do not affect the generally correct you -water (+visualization of justification results using graphical data). | Allowed 3-4 неточности в использовании понятийного материала, незначительные погрешности в обобщениях и выводах, которые не влияют на хороший общий уровень выполнения задания. | Conclusions on the applicability of well-founded scientific principles are vague and unconvincing, there are stylistic and grammatical errors, as well as inaccuracies in processing the results of a practical solution | The task was completed with gross errors, the answers to the questions were incomplete, the conceptual material and argumentation were poorly used. | The task has not been completed, there are no answers to the questions posed, materials and analysis tools have not been used. Violation of the Rules for conducting final control. |

Exam tickets consist of 3 questions. For correctly completed tasks, the maximum is 100 points, of which 33 points for the first question, 33 points for the second question, and 34 points for the third question.

**Formula for calculating the final grade:**

Final grade = score for question 1 + score for question 2 + score for question 3

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| Additional Information: |
| |  |  |  |  | | --- | --- | --- | --- | | **Letter Grade** | **Grade Point Value** | **Percentage** | **Conventional Grade** | | A | 4,0 | 95-100 | Excellent | | A- | 3,67 | 90-94 | | B+ | 3,33 | 85-89 | Good | | B | 3,0 | 80-84 | | B- | 2,67 | 75-79 | | C+ | 2,33 | 70-74 | | C | 2,0 | 65-69 | Satisfactory | | C- | 1,67 | 60-64 | | D+ | 1,33 | 55-59 | | D | 1,0 | 50-54 | | FX | 0,5 | 25-49 | Failure | | F | 0 | 0-24 | | I (Incomplete) | - | - | Incomplete (shall not be taken into account when calculating GPA) | | AU (Audit) | - | - | Audit (shall not be taken into account when calculating GPA) | | Cert. | - | 30-60 50-100 | "Certification" (shall not be taken into account when calculating GPA) | | Uncert. | - | 0-29 0-49 | "Uncertification" (shall not be taken into account when calculating GPA) | | R-difference | - | - | "Discipline difference on curriculum" (shall not be taken into account when calculating GPA) | |

**Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kurmanbayeva M.S.**

**Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kistaybayeva A.S.**

**Lecturer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kenzhebayeva S.S.**