**AL-FARABI KAZAKH NATIONAL UNIVERSITY**

**Faculty of Biology and Biotechnology**

**Department of Biotechnology**

**AFFIRM**

**Dean of the Faculty**

**\_\_\_\_\_\_\_\_\_\_\_\_\_ Kurmanbayeva M.S.**

**“28” May 2024 Protocol No. 11**

**EDUCATIONAL AND METHODOLOGICAL COMPLEX OF DISCIPLINE**

«101807 – Quality and safety management systems of bioproducts»

7M05109 – Biotechnology

Course – 2

Semester – 3

Number of credits – 9

**Almaty 2024**

Educational and methodological complex of discipline was compiled by Dr. Aigerim Mamirova, PhD.

Based on the educational program 7M05109 – “Biotechnology”

Considered and recommended at a meeting of the biotechnology department

from May 20, 2024, Protocol No. 12

Head of the Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kistaubayeva A.S.

(signature)

**SYLLABUS**

**Fall semester 2024-2025 academic year**

**Educational program "7M05109 – Biotechnology"**

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| **ID and course title** | | | **Independent student work (IWS)** | | | **Credits** | | | | **Total Credits** | **Independent student work under teacher guidance (IWST)** |
| **Lectures (L)** | | **Practical classes (PC)** | **Lab. classes (LC)** |
| **101807 –** Quality and safety management systems of biological products | | | 4 | | | 3 | | 6 | 0 | 9 |  |
| **ACADEMIC INFORMATION ABOUT THE COURSE** | | | | | | | | | | | |
| **Learning Format** | | | **Cycle, component** | | **Lecture types** | | | **Types of practical classes** | | **Form and platform final control** | |
| *Offline* | | | Additional | | Problematic, analytical | | | Problem solving, situational tasks, discussions | | Test in Univer system | |
| **Lecturer(s)** | | | Dr. Aigerim Mamirova | | | | | | |
| **e-mail:** | | | [aigerim.mamirova@mail.com](mailto:aigerim.mamirova@mail.com) | | | | | | |
| **Assistant(s)** | | | Meldebekova Aliya Abdugapparovna | | | | | | |
| **e-mail:** | | |  | | | | | | |
| **ACADEMIC COURSE PRESENTATION** | | | | | | | | | | | |
| **Purpose of the course** | | | **Expected Learning Outcomes (LO)\*** | | | | | | | **Indicators of LO achievement** | |
| To acquaint students with quality and safety management systems in bioproducts, focusing on microbiological contamination control, risk assessment, and regulatory compliance. This course covers topics such as identifying and managing physical, chemical, and biological hazards, applying quality control methods for bioproducts, and selecting appropriate microorganism strains that align with product safety standards. Students will gain a comprehensive understanding of contamination control techniques, production process safety, sterility maintenance, and hygiene standards for industrial equipment and bioproduct manufacturing processes | | | 1. Recognize and evaluate physical, chemical, and biological hazards in bioproducts, including microbial contamination risks, and understand their potential impacts on product safety. | | | | | | | 1.1 Can identify physical, chemical, and biological hazards during risk assessments and safety evaluations. | |
| 1.2 Can analyse real-world case studies, highlighting specific hazards and their potential impact on bioproduct safety. | |
| 2. Implement safety management systems such as HACCP and ISO standards, designing critical control points for bioproduct manufacturing and distribution to mitigate contamination risks. | | | | | | | 2.1 Can create a detailed HACCP plan for a given bioproduct manufacturing process during a group assignment. | |
| 2.2 Can apply ISO and HACCP principles in a practical seminar activity to design a contamination control plan. | |
| 3. Critically assess real-world case studies of bioproduct safety failures and successes, understanding the root causes and applying solutions to prevent future incidents. | | | | | | | 3.1 Can present a comprehensive analysis of a bioproduct safety failure, discussing the root causes and preventive measures. | |
| 3.2 Can contribute critical insights during group discussions on real-world industry safety issues and potential solutions. | |
| 4. Explore new biotechnological innovations for improving bioproduct safety and quality, such as personalized probiotics and synbiotics, and evaluate their safety protocols. | | | | | | | 4.1 Can present a report or project on the application of biotechnology tools for improving bioproduct safety, incorporating innovation and practical implications. | |
| 4.2 Can integrate personalized probiotic safety protocols into an assignment or group project, demonstrating creative problem-solving. | |
| 5. Develop comprehensive safety plans tailored to bioproducts involving microorganisms, including fermentation processes, allergen management, and naturally occurring contaminants. | | | | | | | 5.1 Can submit a safety plan that addresses allergens, microbial hazards, and contamination control, demonstrating strong understanding in the assignment. | |
| 5.2 Can articulate the specific safety requirements for different bioproduct types (e.g., fermented products) in a seminar presentation. | |
| **Prerequisites** | | | Microbiology, Food Safety, and Biotechnology Concepts | | | | | | | | |
| **Postrequisites** | | | Ecological Safety of Bioproducts | | | | | | | | |
| **Learning Resources** | | | **Literature:** main, additional.  1. Andersen, V., Lelieveld, H. L. M. & Motarjemi, Y. *Food Safety Management: A Practical Guide for the Food Industry*. (Academic Press, 2023).  2. Cooper, J., Leifert, C. & Niggli, U. *Handbook of Organic Food Safety and Quality*. (Elsevier, 2007).  3. Heijden, K. V. der. *International Food Safety Handbook: Science, International Regulation, and Control*. (Routledge, 2019).  4. Roberts, C. A. & Roberts, C. *The Food Safety Information Handbook*. (Oryx Press Westport, CT, 2001).  5. Schmidt, R. H. & Rodrick, G. E. *Food Safety Handbook*. (John Wiley & Sons, 2005).  6. Taylor, M. *Handbook of Natural Antimicrobials for Food Safety and Quality*. (Elsevier, 2014).  7. Varzakas, T. & Tzia, C. *Handbook of Food Processing: Food Safety, Quality, and Manufacturing Processes*. (CRC Press, 2015).  **Professional scientific databases**  1. <http://www.ncbe.reading.ac.uk>  2. <https://corn.org/analytical-methods/>  **Internet resources**  1. <http://elibrary.kaznu.kz/ru>  2. <http://www.libgen.is/>  **Software**  1. RStudio  2. BioRender  3. Excel MS | | | | | | | | |
| **Academic 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](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) 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 aigerim.mamirova@mail.com*.*  **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 for educational achievements** | | | | | | | **Assessment Methods** | | | | |
| **Grade** | **GPA** | **Score, %** | | **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 during 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, and 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 & summative assessment** | | | | **Points % content** |
| B- | 2.67 | 75-79 | | Work in practical classes | | | | 25 |
| C+ | 2.33 | 70-74 | |
| C | 2.0 | 65-69 | | Satisfactorily | | | Independent student works | | | | 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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| **Week** | **Topic name** | **Hours** | **Max. score** |
| **MODULE 1: FOUNDATIONS IN BIOPRODUCTS SAFETY** | | | |
| **1** | **L 1.** Overview of Bioproducts Safety and Risks | 2 | 0 |
| **PC 1**. Case study on microbial contamination in a biotechnology company | 4 | 8 |
| **2** | **L 2.** Physical and Chemical Hazards in Bioproducts | 2 | 0 |
| **PC 2.** Hands-on activity: Evaluating bioproduct safety data sheets | 4 | 8 |
| **IWST 1.** Consultations on the implementation of **IWS 1** |  |  |
| **3** | **L 3.** Biological Hazards in Bioproducts | 2 | 0 |
| **PC 3.** Bacterial hazard identification in bioproducts | 4 | 8 |
| **4** | **L 4.** Naturally Occurring Contaminants and Toxicants in Plants | 2 | 0 |
| **PC 4.** Group activity: Identifying plant-based bioproducts with inherent risks | 4 | 8 |
| **IWS 1.** Risk Assessment of Naturally Occurring Contaminants in Plant-Based Bioproducts | 1 | 22 |
| **5** | **L 5.** Allergen Management and Best Practices | 2 | 0 |
| **PC 5.** Interactive discussion: Allergen labeling and consumer safety | 4 | 8 |
| **MODULE 2: CONTROLLING CONTAMINATION AND IMPLEMENTING SAFETY PROTOCOLS** | | | |
| **6** | **L 6.** Microbial Contamination Control in Bioproducts | 2 | 0 |
| **PC 6.** Laboratory demonstration: Testing microbial contamination levels | 4 | 8 |
| **IWST 2.** Consultations on the implementation of **IWS 2** |  |  |
| **7** | **L 7.** HACCP and Food Safety Management Systems | 2 | 0 |
| **PC 7.** Activity: Designing a HACCP plan for a bioproduct production facility | 4 | 8 |
| **IWS 2.** HACCP Plan Development for a Bioproduct Manufacturing Process | 1 | 22 |
| **Midterm control 1** | | | **100** |
| **8** | **L 8.** ISO Standards and Certifications in Bioproduct Safety | 2 | 0 |
| **PC 8.** Simulation: Preparing for a quality audit in a bioproduct facility | 4 | 7 |
| **IWST3.** Consultations on the implementation of **IWS 3** |  |  |
| **9** | **L 9.** Safety in Bioproduct Packaging and Distribution | 2 | 0 |
| **PC 9.** Group project: Developing a contamination prevention plan | 4 | 7 |
| **10** | **L 10.** Case Study: Failures in Bioproduct Safety | 2 | 0 |
| **PC 10.** Group discussion: Analysis of the case study and solutions | 4 | 7 |
| **IWS 3.** Case Study Analysis of a Bioproduct Safety Failure | 1 | 22 |
| **MODULE 3: ADVANCED TOPICS AND INDUSTRY APPLICATIONS** | | | |
| **11** | **L 11.** Biotechnology Tools for Ensuring Bioproduct Safety | 2 | 0 |
| **PC 11.** Hands-on workshop: Application of molecular techniques for safety assessment | 4 | 7 |
| **12** | **L 12.** Managing Safety in Fermented Bioproducts | 2 | 0 |
| **PC 12.** Lab activity: Monitoring safety in fermented bioproducts | 4 | 7 |
| **13** | **L 13.** Personalization in Probiotics and Synbiotics | 2 | 0 |
| **PC 13.** Project: Designing personalized bioproducts with safety protocols | 4 | 7 |
| **IWST4.** Consultations on the implementation of **IWS 4** |  |  |
| **14** | **L 14.** Innovations in Bioproduct Safety Management | 2 | 0 |
| **PC 14.** Recent advances in quality management of bioproducts | 4 | 7 |
| **15** | **L 15.** Climate Change and Food Safety | 2 | 0 |
| **PC 15.** Contribution of food production on Climate Change | 4 | 7 |
| **IWS 4.** Innovations in Bioproduct Safety Management: A Future Perspective | 1 | 22 |
| **Midterm control 2** | | | **100** |
| **Final control (exam)** | | | **100** |
| **TOTAL for course** | | | **100** |

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| **Dean** |  | **Kurmanbayeva M.S.** |
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| **Head of Department** |  | **Kistaubayeva A.S.** |
|  |  |  |
| **Lecturer** |  | **Mamirova A.A.** |