**Al-Farabi Kazakh National University**

**Faculty of Biology and Biotechnology**

**Department of Biotechnology**

**Final exam program for**

**Biological engineering by discipline**

**100645 Microbial Engineering**

2023-2024

The program of the final exam of the discipline Microbial Engineering was compiled by L.Z.Musralina senior lecturer of the Department of Biotechnologylogy

Reviewed and approved at a meeting of the Department of Biotechnology

From «24 » 05 2023 year, protocol № 09

Head Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kistaubaeva A.S.

**The final exam form for the discipline is writing in the Univer system.**

The exam in the discipline " Introduction to Biological Engineering " will be conducted in the form of writing in the Univer system, according to the schedule (exam duration - 90 minutes).

 The bank of test questions for a discipline is aimed at checking the achievement of learning outcomes and contains questions for testing cognitive (knowledge and understanding of the learning object), systemic (ability to synthesize and evaluate information) and functional (ability to apply and analyze information) competencies.

**Topics for which assignments will be drawn up**

 The list of topics submitted for consideration in the final exam in accordance with the syllabus of the discipline. The list of topics should cover lectures, seminars, laboratory works as well as tasks submitted to the IWS.

**The exam will include the following sections of the course.**

1. Introduction to Microbial Engineering
2. Standards of medical equipment in medical institutions
3. Classification of biomedical and environmental equipment.
4. Historical Perspectives and Milestones in Microbial Engineering
5. Fundamentals of Microbial Physiology
Genetic Manipulation Techniques in Microbial Engineering
6. Introduction to Metabolic Engineering
7. Case Studies in Metabolic Engineering Successes and Challenges
8. Bioengineering methods
9. Algorithm, analyse data in biomedicine.
10. Analysis on R Studio
11. Applications of Microbial Engineering in Biotechnology
12. Ethical and Safety Considerations in Microbial Biotechnology
13. Introduction to Synthetic Biology
14. Designing Microbial Systems for Specific Applications
15. Basics of Bioprocess Engineering
16. Scale-Up and Optimization of Microbial Cultures
17. Microbial Physiology and Genetics
18. Plan, design, develop, install, operate, and maintain devices, equipment, and complexes for prevention, diagnosis, and treatment.
19. Planning the maintenance of medical equipment.
20. Environmental Microbial Engineering
21. Cutting-Edge Technologies in Microbial Engineering
22. Conduct research and observations on the interaction of biological, natural and artificial systems.
23. Emerging Trends and Future Directions in the Field
24. Metabolic Engineering Principles
25. Laboratory Techniques in Microbial Engineering
26. Experimental Design and Data Analysis in Microbial Engineering
27. Interpret the results of biomedical experiments, assessing the relationship between the structure of biomolecules and their functions at the molecular level
28. Example using Engineering Molecular Cell Biology
29. Biochemical processes in medical biotechnology.
30. Biomedical engeneering
31. Microbial Biotechnology Applications
32. Industry Applications of Microbial Engineering

**Information resources**

Basic

1. Z. Sterbacek Microbial Engineering First International Symposium on Advances in Microbial Engineering/ [Elsevier Science](https://www.google.com.my/search?hl=kk&gbpv=1&dq=Microbial+Engineering&printsec=frontcover&q=inpublisher:%22Elsevier+Science%22&tbm=bks&sa=X&ved=2ahUKEwjJ7fiA9cCDAxWhRmcHHd1zCAMQmxMoAHoECCAQAg), 2016, - 134 p. - ISBN 9781483155647, 1483155641;
2. Lucy Phillip Microbial Engineering: Principles, Methods and Applications / Syrawood Publishing House, 2017. - 244 p. - ISBN 9781682864098, 168286409X;
3. Chandravanu Dash, Mrutyunjay Suar, Namrata Misra Microbial Engineering for Therapeutics / Springer Nature Singapore, 2022, - 374 p. - ISBN 9789811939792, 9811939799
4. Vijai G. Gupta, ‎Anita Pandey New and Future Developments in Microbial Biotechnology and Bioengineering, Elsevier Science, 2019, - 462 p. - ISBN 9780444635044, 0444635041
5. Ajay Kumar Singh, Chaitanya G. Joshi, Madhvi Joshi, Poonam Bhargava, Vijai Singh, Engineering of Microbial Biosynthetic Pathways / Springer Nature Singapore, 2020, - 318 p. - ISBN 9789811526046, 9811526044;
6. Y. Kang and J. D. Keasling. 2006. "Increasing mevalonate production by engineering the

metabolism of Escherichia coli." Lake Arrowhead Conference, Lake Arrowhead, CA, September

2006;

1. L. d’Espaux, A. Reider Apel, M. Wehrs, A. Ghosh, R. A. Li, D. Sachs, M. Garber, W. Zhuang, J.

Gin, L. J. G. Chan, O. Nnadi, C. J. Petzold, N. Hillson, H. Garcia Martin, A. Mukhopadhyay, and

J. D. Keasling. 2016. "A Cas9-based toolkit to program gene expression in Saccharomyces

cerevisiae.” 5th Int'l Conf on Biomolecular Engineering, Austin TX.

1. S. Curran and J. D. Keasling. 2018. “In vitro investigations into a type I modular/iterative

polyketide synthase module.” John Innes/Rudjer Bošković Summer Schools in Applied Molecular Microbiology, Dubrovnik, Croatia

Additional

1. Casida L.E. "Industrial Microbiology"

2. Presscott Dunn "Industrial Microbiology"

3. Wulf Cruger and Anneliese Crueger "Biotechnology: A Textbook of Industrial Microbiology"

4. S.M. Reddy "Basic Industrial Biotechnology"

**Research infrastructure**

1. Laboratories of Biology and Biotechnology Faculty

**Professional scientific databases**

1. https://scopus.com

2. https://pubmed.ncbi.nlm.nih.gov/

**Internet resources**

1. <http://elibrary.kaznu.kz/ru>

2.<https://biglibrary.ru/category47/book144/part66/>

3.<http://cbio.ru/>

**CRITERION ASSESSMENT RUBRIC OF FINAL SUPERVISION**

**"Biotechnology" specialty**

**STANDARD EXAMINATION: WRITTEN**

**Subject:** Introduction to Biological Engineering **Form: traditional written/online. Platform: - Univer kaznu**

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|  |  **Score** | **DESCRIPTORS** |
| **№** | **Criterion** | **"Excellent"** | **"Good"**  | **"Satisfactory"** | **"Unsatisfactory"** |
| **90-100 % % (27-30 score)** | **70-89% (21-26 score)** | **50-69% (15-20 score)** | **25-49% (8-14 score)** | **0-24% (0-7 score)** |
| **1 question****30 score** | Knowledge and understanding of course theory and concepts | The student has fully mastered the subject in the study program, mastered the subject in sufficient depth; responds to the assigned task independently in a logical sequence and comprehensively, identifies the most basic, is able to analyze, compare, classify, supplement, clarify and systematize the read material; in this regard, he identifies the main points and determines cause-and-effect relationships; wrote the answers with specific, necessary examples; writes answers in competent scientific language, correctly uses and explains all scientific terms and concepts. Familiar with basic and secondary literature. | The student has mastered the knowledge of the subject almost completely according to the program (there are gaps in the knowledge of some, especially complex chapters); cannot always distinguish the most basic ones, and also does not allow significant mistakes in the answer; can write situational tasks of easy and medium difficulty;The answers are not completely correct in competent scientific language and | The learner has mastered the main amount of knowledge on the subject; It is difficult for him to write an answer by himself, he creates imprecise wording. Able to perform only light tasks,Focuses on general course content but has difficulty uncovering specific issues.correct conclusions are crossed with incorrect conclusions.allows to break the logic and sequence of the material presentation, makes mistakes in answering questions. | The answers do not correspond to the content of the questions. Key concepts in the questions for the training course are written incorrectly.Inadequate coverage of the questions, incorrect reasoning, factual and verbal errors, predicting the wrong conclusion. | The learner has no answers to the questions; it is determined that he does not know or understand an important part of the study material. The learner has not mastered the mandatory minimums of knowledge in the subject. He does not know the basic concepts and theories. It cannot make rules for conducting final control. |
| **2 question****30 score** | Application of selected methodology and technology to real practical tasks | The selected methodology and technology are applied in a deep sense to specific practical tasks; freely applies scientific concepts to the task, solves the main problem in a logical and evidence-based manner. Completes the study assignment, writes a detailed, reasoned answer to the question, and then can solve the practical problems of the course. | In the process of fully applying the chosen methodology and technology to real practical tasks, there will be shortcomings.The methodology of the course and the knowledge gained by the student are incompletely integrated and adapted to solve the presented real practical problems. the answers are not clearly structured, there are some unimportant mistakes in the answer;Writes a reasoned answer to the question that is not fully completed in part, unable to fully solve the practical problems of the course. | Cannot sufficiently apply the chosen methodology and technology to real practical tasks.The theoretical knowledge and tools of the course are superficially used, the content is small, there are inaccuracies in the answers, the presented material does not make sense, it is not written explaining the interdisciplinary connections.The material is fragmented, breaks the logical sequence and allows factual and semantic inaccuracies. | Cannot apply the selected methodology and technology to real practical tasks. Does not use the important part of the subject correctly, makes serious mistakes that cannot be corrected by oneself, does not write correct answers to additional questions on the content of the task. He cannot write the solution of the tasks, there are errors and shortcomings in the general execution of the tasks. | Can't use knowledge and algorithms to solve tasks; cannot draw conclusions and conclusions. makes gross mistakes when writing answers, does not master the material.It cannot make rules for conducting final control. |
|  |  **Score** | **DESCRIPTORS** |
| **№** | **Criterion** | **"Excellent"** | **№** | **Criterion** | **"Excellent"** |
| **90-100 % % (27-30 score)** | **70-89% (28-35 балл)** | **50-69% (20-27 балл)** | **90-100 % % (27-30 score)** | **0-24% (0-9 балл)** |
| **3 question****40 score** | Evaluation and analysis of the application of the selected methodology to the proposed practical/seminar task, justification of the obtained result | If the device or technology is not used, it can be integrated, integrated, integrated, integrated, integrated, integrated and integrated, Communication technology and integration theories should be taken into account when using the device.Doing so may cause the device to become uncomfortable, and may result in fire or electric shocks, which may result in fire or electric shockAnalyzing and analyzing the situation may cause the device to become unstable;The laboratory is designed to provide a wide range of information and technology, as well as a wide range of information and knowledge, The laboratory and instrumentation are not to be used in the laboratory. | It is important to have a practical and laboratory approach to teaching and learning, as well as to be aware of the technical and technical aspects of teaching and learning.Communication technology and the theory of integration and integration.It is important to be aware of the importance of the use of tools and tools in the development of communication technology. | Doing so will cause the device to become unstable, and may cause the material to deteriorate, if the material is not used.Communication technology and theory are integrated and integrated. | Doing so may cause the device to become unstable and may result in fire or electric shock.The laboratory and instrumental equipment must not be used for any other purpose.Doing so may result in damage to the device, damage to the environment, and damage to the material and the product. | The material used in this manual is not intended for use in the classroom. Communication technology and integration theory can be integrated into the workplace; It is recommended to use the following materials, materials, materials and materials that can be used in the classroom.Please observe the following instructions. |

**The following formulas:**

**Final score (FS) = Score (1 question (theory) + Score (2 question (theory)) + Score (3 question (practice)).**

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| Alphabetical grading | Numerical equivalent of score | % value | Evaluation according to the traditional system |
| А | 4,0 | 95-100 | Excellent |
| А- | 3,67 | 90-94 |
| В+ | 3,33 | 85-89 | Good |
| В | 3,0 | 80-84 |
| В- | 2,67 | 75-79 |
| С+ | 2,33 | 70-74 | Satisfactory |
| С | 2,0 | 65-69 |
| С- | 1,67 | 60-64 |
| D+ | 1,33 | 55-59 |
| D- | 1,0 | 50-54 |
| F | 0 | 0-49 | Unsatisfactory |
| I (Incomplete) | - | - | The subject is not finished*(Does not count when calculating GPA)* |
| P (Pass) | **-** | **-** | «Calculated»*(Does not count when calculating GPA)* |
| NP (No Рass) | **-** | **-** | «Does not count»*(Does not count when calculating GPA)* |
| W (Withdrawal) | - | - | «Abandon the subject»*(Does not count when calculating GPA)* |
| AW (Academic Withdrawal) |  |  | Withdrawal from the subject for academic reasons*(Does not count when calculating GPA)* |
| AU (Audit) | - | - | «Subject heard»*(Does not count when calculating GPA)* |
| Атт-ған  |  | 30-6050-100 | Certified |
| Атт-маған |  | 0-290-49 | Not certified |
| R (Retake) | - | - | Reread the subject |