**SYLLABUS**

**Fall semester 2021-2022 academic years**

**on the educational program “Biological Engineering”**

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| **Discipline’s code** | **Discipline’s title** | **Independent work of students (IWS)** | **No. of hours per week** | | | | | **Number of credits** | **Independent work of student with teacher (IWST)** |
| **Lectures (L)** | **Practical training (PT)** | | **Laboratory (Lab)** | |
| MV 2210 | Microorganisms and Viruses | 98 | 15 | 15 | | 15 | | 5 | 7 |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Number of IWS** | | **Form of final control** |
|  | Theoretical | Problematic, analytical | | | Task execution | | 3 | | Exam |
| Lecturer | Akimbekov S. Nuraly, Ph.D., Post.Doc., Assistant Professor. | | | | | | According to the class timetable | | |
| e-mail | [kaznu.nur@gmail.com](mailto:kaznu.nur@gmail.com) [akimbekov.nuraly@kaznu.kz](mailto:akimbekov.nuraly@kaznu.kz) | | | | | |
| Telephone number | 3773327 | | | | | |

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| **Academic presentation of the course** |

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| **Aim of course** | **Expected Learning Outcomes (LO)**  As a result of studying the discipline the undergraduate will be able to: | **Indicators of LO achievement (ID)**  (for each LO at least 2 indicators) |
| The aim of the course is to introduce students to basic characteristics of  microbes (morphology, cytology, metabolism) and viruses (architecture,  taxonomy, reproduction), their ecologies and importance for life cycles in the  biosphere, for branches of industry (biotechnology, medicine, agriculture, food,  pharmaceutics, etc.) | **1.** The scope of microbiology.  - to define the general characteristics of microorganisms and their roles in the earth’s environments;  - to describe the historical foundations of microbiology;  - to identify the methods of studying microorganisms;  - to define the basic characteristics of prokaryotic cells;  - to evaluate the prokaryotic profiles, i.e. bacteria and archaea. | **1.1.** Define microbiology and microorganisms, and identify the major microorganisms.  **1.2.** Detect the primary areas included in microbiological studies.  **1.3.** Learn the basic characteristics of prokaryotic cells and eukaryotic cells.  **1.4.** Gain the knowledge about ways microorganisms may be applied to solve human problems.  **1.5.** Outline the major events in the history of microbiology, including the major contributors to the early development of microbial techniques/methods. |
| **2.** Taxonomy: organizing, classifying, and naming microorganisms.  - to describe the origin and evolution of microorganisms;  - to identify the classification systems of prokaryotic cells;  - to make a survey of prokaryotic groups with unusual characteristics;  - to describe the microbial shapes, arrangements, and sizes. | **2.1.** Gain the knowledge about taxonomy and its supporting terms classification, nomenclature, and identification.  **2.2.** Explain how the levels of a taxonomic ranks relate to each other.  **2.3.** Ability to give the names of the taxonomic levels, and place them in a hierarchy.  **2.4.** Describe the goals of nomenclature and know the binomial system is structured.  **2.5.** Know how to correctly write a scientific name. |
| **3.** A survey of prokaryotic cells.  - to define the basic characteristics of cells and life forms;  - to describe the structure of a generalized bacterial cell;  - to characterize the cell extensions and surface structures;  - to analyze the internal and external structures of a microbial cell;  - to define the cell envelope: the outer boundary layer of bacteria. | **3.1.** Describe the fundamental characteristics of prokaryotic cells.  **3.2.** Characterize the organization of a prokaryotic cell. Describe the generalized anatomy of bacterial cells.  **3.3.** Explain the concept of the cell envelope, and describe its structure. Outline the structure and functions of cell walls, and explain the role of peptidoglycan.  **3.4.** Summarize how gram-positive and gram-negative cells differ in their reactions. Describe the structure of the cell membrane, and explain several of its major roles in bacterial cells.  **3.5.** Ability to list the contents of the cell cytoplasm. Describe the life cycle of endospore-forming bacteria. |
| **4.** A survey of eukaryotic cells and microorganisms.  - to describe the form and function of the eukaryotic cell;  - to characterize the external and internal structures of eukaryotic cells;  - to make eukaryotic-prokaryotic comparations;  - to identify the taxonomy of eukaryotic cells;  - to make a survey on the kingdom of the fungi. | **4.1.** Describe the plan of a basic eukaryotic cell and organelles, and indicate the structures all cells possess.  **4.2.** Define the glycocalyx for eukaryotic cells and list its basic functions.  **4.3.** Characterize the cell wall and membrane of eukaryotic cells.  **4.4.** Compare and contrast prokaryotic cells, eukaryotic cells, and viruses.  **4.5.** Outline the basics of eukaryotic taxonomy. |
| **5.** Overview of viruses.  - to describe the general structure of viruses;  - to characterize the modes of viral multiplication;  - to identify the classification of viruses;  - to define the techniques in cultivating and identifying viruses;  - to characterize the viral infection, detection and treatment. | **5.1.** Describe the unique characteristics of viruses.  **5.2.** Discuss the origin and importance of viruses.  **5.3.** Explain the functions of capsids, nucleocapsids, envelopes, and spikes.  **5.4.** Summarize the different viral groups based on their basic structure.  **5.5.** Explain the classification scheme used for viruses. |
| **Prerequisites** | Low molecular biological substances, The basics of biotechnology | |
| **Post requisites** | Microbial biotechnology, Environmental biotechnology, Food biotechnology, Industrial biotechnology. | |
| **Information resources** | **Traditional sources:**  1. Savitskaya I.S., Kistaubaeva A.S. Microbiology and virology. - 2014.  2. Talaro K. P., Barry Ch. Foundations in Microbiology. - 2012.  3. Eugene W. Nester and etc. Microbiology: a human perspective. - 2020.  4. Hogg S. Essential Microbiology. - 2013.  5. Willey G.M., Sherwood L.M., Woolverton C.J. Prescotts’s principles of microbiology. - 2019.  6. Prescott, Harley, and Klein’s. Microbiology. - 2020.  7. Moselio Schaechter. Encyclopedia of microbiology. - 2019.  **Online sources:**  <https://study.com/academy/course/microbiology-course.html>  <https://www.edx.org/learn/microbiology>  <https://www.coursera.org/courses?query=microbiology>  <https://bmcmicrobiol.biomedcentral.com/> | |

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| **Academic policy of the course in the context of university moral and ethical values** | **Academic Behavior Rules:**  All students have to register at the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the discipline study schedule.  ATTENTION! Non-compliance with deadlines leads to loss of points! The deadline of each task is indicated in the calendar (schedule) of implementation of the content of the curriculum, as well as in the MOOC.  **Academic values:**  - Practical trainings/laboratories, IWS should be independent, creative.  - Plagiarism, forgery, cheating at all stages of control are unacceptable.  - Students with disabilities can receive counseling at e-mail [kaznu.nur@gmail.com](mailto:kaznu.nur@gmail.com) |
| **Evaluation and attestation policy** | **Criteria-based evaluation:**  assessment of learning outcomes in relation to descriptors (verification of the formation of competencies in midterm control and exams).  **Summative evaluation:** assessment of work activity in an audience (at a webinar); assessment of the completed task. |

**CALENDAR (SCHEDULE) THE IMPLEMENTATION OF THE COURSE CONTENT:**

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| Weeks | | Topic name | LO | ID | Unt of hours | | Maximum score | Form of knowledge assessment | The form of the lesson  / platform |
| **Module 1. Prokaryotes** | | | | | | | | | |
| 1 | **L.1.** Introduction. A subject of microbiology and its issues. | | LО-1 | ID-1.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 1.** Work rules in microbiological laboratory. | | LО-1 | ID-1.1.  ID-1.2. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| 2 | **L.2.** Features of microorganisms. | | LО-1 | ID-1.2.  ID-1.3. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 2.** Methods of studying microorganisms. | | LО-1 | ID-1.3.  ID-1.4. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWST 1.** | | LО-2 | ID-1.2. | |  | 10 | Application-oriented | Univer system. |
| 3 | **L.3.** Pro- and eukaryotic cells, and their differences. | | LО-1 | ID-1.3.  ID-4.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 3.** Magnification and microscope. | | LО-1 | ID 1.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWS 1.** Useful microorganisms and their features. | | LО-2 | ID-1.2.  ID-1.4. | |  | 30 | Logic task | Univer system. |
| **Module 2. Bacterial Cell Structures** | | | | | | | | | |
| 4 | **L.4.** Bacterial cell structure: Surface layers - 1. | | LО-2 | ID-2.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 4.** Preparing specimens for optical microscopes. | | LО-2 | ID-2.1.  ID-2.2. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| 5 | **L.5.** Bacterial cell structure: Surface layers - 2. | | LО-3 | ID-3.1.  ID-3.2. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 5.** Features of the Six “I’s”. | | LО-2 | ID-2.1.  ID-2.4. | | 1 | 10 | Task-oriented | Practice via Microsoft Teams. |
| **IWST 2.** | | LО-2 | ID-2.3.  ID-2.5. | |  | 10 | Application-oriented | Univer system. |
| **IC 1.** | |  |  | |  | 100 |  |  |
| 6 | **L.6.** Bacterial cell structure: Internal components and inclusions - 1. | | LО-3 | ID-3.2. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 6.** Inoculation techniques. | | LО-3 | ID-1.3.  ID-3.2. | | 1 | 10 | Task-oriented | Practice via Zoom. |
| 7 | **L.7.** Bacterial cell structure: Internal components and inclusions - 2. | | LО-3 | ID-3.4. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 7.** Growth and identification of cultures. | | LО-3 | ID-3.4.  ID-3.5. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWST 3.** | | LО-3 | ID-3.1. | |  | 10 | Logic task | Univer system. |
| **Module 3. Biology of Microorganisms** | | | | | | | | | |
| 8 | **L.8.** Microbial reproduction – 1. | | LО-2 | ID-2.4.  ID-2.5. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 8.** Isolation techniques. | | LО-3 | ID-3.1.  ID-3.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWS 2.** Harmful microorganisms and their features. | | LО-1 | ID-1.4. | |  | 30 | Logic task | Univer system. |
| 9 | **L.9.** Microbial reproduction – 2. | | LО-3 | ID-3.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 9.** Inspection techniques. | | LО-3 | ID-3.1.  ID-3.3. | | 1 | 10 | Task-oriented | Practice via Zoom. |
| 10 | **L.10.** Microbial differentiation. | | LО-4 | ID-4.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 10.** Media for culturing. | | LО 1 | ID-3.1.  ID-3.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWST 4.** | | LО-4 | ID-4.1.  ID-4.2. | |  | 10 | Logic-task | Univer system. |
| **MT 1.** | |  |  | |  | 100 |  |  |
| 11 | **L.11.** Microbial communities: biofilms. | | LО-4 | ID-4.1.  ID-4.2. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 11.** Information gathering techniques. | | LО-4 | ID-4.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| 12 | **L.12.** Systematic groups of microorganisms. | | LО-4 | ID-4.2. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 12.** Identification techniques. | | LО-3 | ID-3.1.  ID-3.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWST 5.** | | LО-4 | ID-4.1. | |  | 10 | Logic-task | Univer system. |
| **Module 4. Virology** | | | | | | | | | |
| 13 | **L.13.** General characteristics of viruses. | | LО-5 | ID-5.1. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 13.** Cultivation of viruses. | | LО-5 | ID-5.1. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWS 3.** Origami Virus. | | LО-5 | ID-5.1.  ID-5.2. | |  | 30 | Application-oriented | Univer system. |
| 14 | **L.14.** Classification of viruses. | | LО-5 | ID-5.3. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 14.** Identification of viruses. | | LО-5 | ID-5.1.  ID-5.3. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| 15 | **L.15.** Bacteriophages. | | LО-5 | ID-5.2.  ID-5.5. | | 2 |  | Problem-oriented | via Microsoft Teams. |
| **PT 15.** Lysogeny. | | LО-5 | ID-5.4. | | 1 | 10 | Task-oriented | via Microsoft Teams. |
| **IWST 6-7.** | | LО-5 | ID-5.1. | |  | 10 | Logic task | Univer system. |
| **IC 2.** | |  |  | |  | 100 |  |  |
|  | **Exam** | |  |  | |  | 100 |  |  |
|  | **Total** | |  |  | |  | 100 |  |  |

Abbreviations: L – lecture; P – practice, IWS – individual work of students; IWST – individual work of students with teacher; IC – intermediate control; MT – midterm

**Dean of the faculty of Biology and Biotechnology Zayadan B.K.**

**Chairman of the Faculty Methodological council Nazarbekova S.T.**

**Head of the Department Kistaubayeva A.S.**

**Lecturer Akimbekov N.S.**