**SYLLABUS**

**Spring semester 2022-2023 academic years**

**on the educational program “Biotechnology”**

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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)** | |
| **OB 2212; OB 2213** | Basics of Biotechnology | 5 |  |  | |  | | 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** |
| Online | Theoretical | Problematic, Analytic | | | Problem solving, situational tasks, video analysis | | 5 | |  |
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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) |
|  | **LO 1.** Conduct a comparative assessment of microbiological processes that ensure the production of high-quality biotechnological products based on the study of the characteristics of food raw materials and finished products | **ID 1.1** Classify the types of sterilization, pasteurization, disinfection and possess methods for evaluating their effectiveness.  **ID 1.2** Determine the ways and conditions of contamination of production by microorganisms and the possibility of their elimination.  **ID 1.3** Conduct microbiological analysis of food products and determine the content of their total number and sanitary-indicative microorganisms. |
| **LO 2** Based on theoretical models predict the nature of changes in the properties of raw materials in the process of its biotransformation and obtain products with the specified quality characteristics | **ID 2.1** Classify the biochemical processes that occur during the storage of food raw materials and finished products to detect defects in products and microorganisms that cause their spoilage.  **ID 2.2** Explain how to control technically harmful and pathogenic microflora.  **ID 2.3** Conduct sanitary and hygienic examination of food products and draw up relevant acts. |
| **LO 3** Operate with basic knowledge in the field of National and international quality control system and biological safety of biotechnological products | **ID 3.1** Formulate the provisions of the regulatory framework for the legal regulation of food safety (the law “On the quality and safety of food products” and other legal acts).  **ID 3.2** Formulate the basic principles for the formation of microbiological quality and safety of raw materials, food products in the HACCP and ISO systems.  **ID 3.3** Classify Regulatory and Technical documentation used in the production of biotechnological products: state and industry documents (GOST; OST; TU; RD); enterprise documentation system |
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| **Prerequisites** | Microbiology and Virology, Physiology of Microorganisms, Low molecular biological substances. | |
| **Post requisites** | Manufacturing Practice | |
| **Information resources** | **Main:**  *1.* Reinhard Renneberg. *Biotechnology for Beginners [2007]. ISBN:* 9780123735812.  2. Gladys Alexandre and etc. Advances in applied microbiology [2009]. ISBN: 978-0-12-374788-4  3. Gareth Price. Biology: An Illustrated Guide to Science [2006]. ISBN-10: 0-8160-6162-9  4. John Wiley & Sons Ltd. Dictionary of Microbiology and Molecular Biology, Third Edition [2006]. ISBN-13 978-0-470-03545-0  5. Moselio Schaechter. Encyclopedia of microbiology. Third edition [2009]. *ISBN:* 9780123749802  6. Talaro-Talaro: Foundations in Microbiology, Fourth Edition [2011]. ISBN: 978-0072320428  **Additional:**  7. Eugene W. Nester and etc. Microbiology: a human perspective, sixth edition [2011]. ISBN 978–0–07–299543–5  8. Prescott, Harley, and Klein’s microbiology, seventh edition [2008]. ISBN 978–0–07–299291–5  9. Nathan S. Mosier, Michael R. Ladisch. Modern biotechnology: connecting innovations in microbiology and biochemistry to engineering fundamentals [2009]. ISBN 978-0-470-11485-8  10. Tortora, Gerard J. Microbiology: an introduction [2010]. ISBN-13: 978-0-321-55007-1  11. Madsen, Eugene L. Environmental microbiology [2008].ISBN-13: 978-1-4051-3647-1  12. Talaro, Kathleen P. Foundations in microbiology. 8th edition [2012]. ISBN 978-0-07-337529-8.  **Internet resources:**  https://www.goodreads.com/  https://www.coursera.org/  https://www.edx.org/  https://ed.ted.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 izmukan@mail.ru. |
| **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 | amount of hours | Maximum score | Form of Knowledge Assessment | The  Form of the lesson  / platform |

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| Module **1** Microbial Biotechnology | | | | | | | |
| 1 | **L.1** Microbial Biotechnology: fundamentals of applied microbiology (Metabolism. Control and Monitoring of Aseptic Processing in Biotechnology). | LО 1 | ID 1.1.  ID 1.2.  ID 1.3. | 1 |  |  | Offline |
| 1 | **Lab 1** Biochemistry and physiology of growth  and metabolism of microorganisms – 1 and – 2. | LО 1 | ID 1.1.  ID 1.2.  ID 1.3. | 2 | 8 | Analysis | Offline |
| 2 | **L.2** Prokaryotic Cells in Biotech Production. Fermentation Biotechnology. Scientific, Technical and Economic Aspects of Microbial Products. Research and Development. | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1. | 1 |  |  | Offline |
| 2 | **Lab 2** Sterilization in Biotechnology. Types of sterilization. Aseptic techniques. | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1. | 2 | 8 | Analysis | Offline |
| 3 | **L.3** Bioreactors, fermentation systems and metabolic pathways. Inoculum, Production Media and Biomass Production in Microbial Biotechnology. Isolation of End Masses as Fermentation Products. | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1.  ID 2.3. | 1 |  |  | Offline |
| 3 | **Lab 3.** Investigation the potentials of isolated cultures from fermented products. | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1.  ID 2.3. | 2 | 8 |  | Offline |
| 3 | **IWSP 1 Consultation on the implementation of IWS1** | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1.  ID 2.3. |  | 5 |  | Offline |
| 3 | **IWS 1.** Commercially important secondary metabolites. | LО 1  LO 2 | ID 1.2.  ID 1.3.  ID 2.1.  ID 2.3. |  | 25 | Logic task | Offline |
| 4 | **L.4** Process management in Microbial Biotechnology: Genome management and analysis in Microbial Biotechnology. Microbial process kinetics | LО 3  LO 4 | ID 3.2  ID 3.3  ID 4.1  ID 4.2  ID 4.3. | 1 |  |  | Offline |
| 4 | **Lab 4.** Investigation the potentials of isolated cultures from dairy products. | LО 2  LO 3 | ID 2.1  ID 2.2  ID 2.3.  ID 3.2  ID 3.3 | 2 | 8 |  | Offline |
| 5 | **L.5** Measurement, monitoring, modelling  and control in Microbial Biotechnology. Regulatory Issues in Biotechnology: Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP). Biosafety Guidelines and Regulations | LО 2 | ID 2.1  ID 2.2  ID 2.3 | 11 |  |  | Offline |
| 5 | **Lab 5.** Isolation the perspective cultures from soil. | LО 2 | ID 2.1  ID 2.2  ID 2.3 | 2 | 8 |  | Offline |
| 5 | **IWSP 2 Consultation on the implementation of IWS2** | LО 2 | ID 2.1  ID 2.2  ID 2.3 |  |  |  | Offline |
| 5 | **IWS 2** Downstream Processing | LО 2 | ID 2.1  ID 2.2  ID 2.3 |  | 10 | Logic task |  |
| 5 | **Make a structural and logical diagram of the read material** | LO 1  LO 2  LO 3 | ID 1.1-1.3  ID 2.1-2.3  ID 3.1-3.3 |  | 10 |  |  |
| **Module 2 Animal Biotechnology** | | | | | | | |
| 6 | **L.6** Animal cell culture technology. Primary Culture. Subculturing. Cell line. Maintenance | LO 1  LO 3 | ID 1.1-1.3  ID 3.1-3.3 |  |  |  | Offline |
| **Lab. 6.** Safety rules in laboratory | LO 2 | ID 2.1-2.3 |  | 10 | Analysis | Offline |
| 7 | **L.7** Cryopreservation of gametes and embryos.  Guidelines for Cryopreservation. Freezing Medium. Cryopreservation Medium. | LO 1  LO 2  LO 3 | ID 1.1-1.3  ID 2.1-2.3  ID 3.1-3.3 |  |  |  | Offline |
| **Lab. 7** Bioethics as the fundamental issues in animal biotechnology. | LO 2  LO 3 | ID 2.1-2.3  ID 3.1-3.3 |  | 10 | Analysis | Offline |
| 5 | **MT 1** |  |  |  | **100** |  |  |
| 8 | **L.8** Totipotency, multipotency, pluripotency of animal cells. | LО 1  LO 2 | ID 1.1.  ID 2.1.  ID 2.3. | 1 |  |  | Offline |
| **Lab. 8** Stem cells. What are stem cells, and why are they important?  Lab Equipment and materials. | LО 1  LO 2 | ID 1.1.  ID 2.1.  ID 2.3. | 2 | 7 | Analysis | Offline |
| **IWSP 3 Consultation on the implementation of IWS3** | LО 2 | ID 2.1  ID 2.2  ID 2.3 |  |  |  |  |
| **IWS 3** “Gene therapy”. “Bioethics and Stem cell therapy” | LО 2 | ID 2.1  ID 2.2  ID 2.3 | 1 | 20 | Logic tasks | Offline |
| 9 | **L.9** Current clinical applications  of stem cell therapy. | LО 1  LО 2 | ID 2.1  ID 2.2  ID 2.3 | 1 |  |  | Offline |
| **Lab. 9** Protocol for Cryopreserving Cultured  Cells. How to Pipette in 5 Simple Steps | Pipetting | LО 1 | ID 1.1. | 2 | 6 | Analysis | Offline |
| 10 | **L.10** Gene cloning by recombinant DNA technology | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab. 10** Recombinant DNA technology Solving tasks. | LО 1  LO 2 | ID 1.1.  ID 2.1.  ID 2.3. | 2 | 6 | Analysis | Offline |
| **Module 3 Plant Biotechnology** | | | | | | | |
| 11 | **L.11** The aim of Plant biotechnology. Basic direction in Plant biotechnology | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab. 11.** Instruction of safety technique. Laboratory Manual/rules of lab work in laminar box, with autoclaves, PCR-thermocycler, shaker, light setup. | LО 1  LO 2 | ID 1.1.  ID 2.1.  ID 2.3.. | 2 | 6 | Analysis | Offline |
| 12 | **L.12** Biology of cultivated plant cells. Principles and methods of cultivation plant cells. | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab. 12.** Prepare solution of microelements, growth regulators **.** |  |  | 2 | 6 |  |  |
| **IWSP 4 Consultation on the implementation of IWS5** | LО 1 | ID 1.1. |  |  |  | Offline |
| **IWS 4** Morphogenesis and regeneration in plant cell culture. Cell technologies for receiving important BAS derived from plant material. | LО 1 | ID 1.1. |  | 16 | Problem task | Offline |
| 13 | **L.13** Technologies, used for saving biodiversity and plant propagation in vitro | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab. 13**  Calculation of stock solutions concentration. Prepare of solid Murashige-Skoog (MS) medium | LО 1 | ID 1.1. | 1 | 6 | Analysis | Offline |
| 14 | **L.14**  Technologies used in plant breeding programs | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab. 14** Cultivation of carrot parenchyma tissue on  MS medium in vitro | LО 1 | ID 1.1. | 1 | 6 | Analysis | Offline |
| 15 | **L.15** Bioengineering methods in plant biotechnology | LО 1 | ID 1.1. | 1 |  |  | Offline |
| **Lab 15** Cultivation of mature wheat embryos in  vitro on MS medium with different phytohormons | LО 1 | ID 1.1. | 1 | 6 | Analysis | Offline |
| **IWSP 5 Consultation on the implementation of IWS5** | LО 5 | ID 5.1. |  |  |  | Offline |
| **IWS 5** Make a structural and logical diagram of the read material | LO 1  LO 2  LO 3 | ID 1.1-1.3  ID 2.1-2.3  ID 3.1-3.3 |  | 15 | Analysis |  |
|  | **Тест** |  |  |  |  |  |  |
|  | **MT 2** |  |  |  | **100** |  |  |

[Abbreviations: QS - questions for self-examination; TK - typical tasks; IT - individual tasks; CW - control work; MT - midterm.

Comments:

- Form of L and PT: webinar in MS Teams / Zoom (presentation of video materials for 10-15 minutes, then its discussion / consolidation in the form of a discussion / problem solving / ...)

- Form of carrying out the CW: webinar (at the end of the course, the students pass screenshots of the work to the monitor, he/she sends them to the teacher) / test in the Moodle DLS.

- All course materials (L, QS, TK, IT, etc.) see here (see Literature and Resources, p. 6).

- Tasks for the next week open after each deadline.

- CW assignments are given by the teacher at the beginning of the webinar.]

**Dean B.K. Zayadan**

**Head of the Department**  **Zh.K. Zhunusbayeva**

**Lecturer A.Z. Izmukan**

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