**Sillabus**

**Fall semester 2020-2021 academic years**

**on the educational program**   
**«5В070100-** Biotechnology **»**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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)** | | **Labora-tory (Lab)** | |
|  | Agricultural Biotechnology |  | 2 | 0 | | 2 | | 3 |  |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Number of IWS** | | **Form of final control** |
| Full-time | Professional  disciplines elective component |  | | | Laboratory works | | In writing form | | tests |
| Lecturer | Kenzhebaeva Saule Sagindikovna | | | | | |  | | |
| e-mail | [Saule.Kenzhabaeva@kaznu.kz](mailto:Saule.Kenzhabaeva@kaznu.kz) | | | | | |
| Telephone number | +7(701)1113149 Кенжебаева С.С. | | | | | |

|  |
| --- |
| **Academic presentation of the course** |

|  |  |  |
| --- | --- | --- |
| **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) |
| To acquaint students with the peculiarities of the essence and applications of the main methods  to show their relationship with environmental conditions.  To form students' ability to know, objects and modern methods, scientific terminology of the subject of molecular diagnostics.  Develop analytical thinking skills to work with various information. | 1. demonstrate knowledge for the essence and applications of the main methods used  in agricultural biotechnology including plants and microorganisms, to analyze information obtained when deciding practical tasks, | 1.1. know the features of the essence for micropropagation technologies of plants, cultivation the plants cells *in vitro,*  types and techniques of tissue culture;  1.2. analyze major steps of tissue culture of plants;  1.3. finds a correspondence between different types of tissue culture such as seed culture and ebryo culture  1.4. demonstrates knowledge about the callus culture techniques;  1.5. based on lecture material and information sources, can write the main steps of process of micropropagation technologies of plants. |
| 2. to select and apply in practice modern methods of agricultural biotechnology, including protoplast culturemolecular cloning research for the qualitative and quantitative analysis of biological products; | 2.1. conducts information search for solving 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 products, in accordance with methodological recommendations in accordance with safety regulations; |
| 3. to interpret the results of types of tissue culture including single cell culture, suspension culture, anther culture, pollen culture and somatic embryogenesis experiments, assessing the relationship between their advantages, choice for decision of practical purpose and applications; | 3.1. records and formalizes the results of experimental work in the required format (tables, graphs, diagrams, etc.)  3.2. assesses 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 performed;  3.5. makes final conclusions from the received data; |
| 4. Demonstrate knowledge of the production of enzymes and bioactive compounds for medical and pharmaceuticals and the production of fermented foods; | 4.1. based on biotechnology of microorganisms apply knowledge about production of enzymes and bioactive compounds for medical and pharmaceuticals s;  4.2 use techniques microorganisms biotechnology to obtain bioactive compounds for medical and pharmaceuticals.  4.3 understand the basics of the production of fermented food and agricultural plants with improved characteristics. |
| 5. to analyze the significant applications of microorganisms in agriculture, industry, health and molecular biology research,  to analyze information obtained when deciding practical tasks. | -5.1. to be able to correctly represent and evaluate applications of microorganisms in agriculture, industry health,  5.2 to be able to choose an approach and method depending on the task. |
| **Prerequisites** | **Cell biology, Plant biochemistry and physiology, Botany** | |
| **Post requisites** | Agricultural Biotechnology, Molecular Biology | |
| **Information resources** | 1. **Main:** Reinhard Renneberg. *Biotechnology for Beginners [2007]. ISBN:*   9780123735812   1. Gladys Alexandre and etc. Advances in applied microbiology [2009]. ISBN: 978-0-12-374788-4 2. Gareth Price. Biology: An Illustrated Guide to Science [2006]. ISBN-10: 0- 8160-6162-9 3. Talaro-Talaro: Foundations in Microbiology, Fourth Edition [2011]. ISBN: 978-0072320428 4. Ditchenko T.I. Culture of plants’cells, tissue and organs: Methodical recommendations for laboratory studies, tasks for independent work and control of students' knowledge – Minsk: BGU, 2007. – 46 p. 5. Glik, B., Pasternak J. Molecular biotechnology. Principles and applications.- M.: “Mir”, 2002. - 589 p.   **Additional:**   1. Eugene W. Nester and etc. Microbiology: a human perspective, sixth edition [2011]. ISBN 978–0–07–299543–5 2. Prescott, Harley, and Klein’s microbiology, seventh edition [2008]. ISBN 978–0–07–299291–5 3. Nathan S. Mosier, Michael R. Ladisch. Modern biotechnology: connecting innovations in microbiology and biochemistry to engineering fundamentals [2009]. ISBN 978-0-470-11485-8 4. Tortora, Gerard J. Microbiology: an introduction [2010]. ISBN-13: 978-0- 321-55007- 5. Madsen, Eugene L. Environmental microbiology [2008].ISBN-13: 978-1- 4051-3647- 6. T.A. Egorova, S.M. Klunova, E.A. Zhivukhin. Fundamentals of biotechnology: a tutorial. - Moscow: "Academy", 2003. - 208 р.   Pershina L.A. Cultivation of isolated cells and tissues of higher plants: a textbook. Part 1. - Novosibirsk: NSU, 2000. – 46 р. | |
| **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 \*\*\*\*\*\*\*@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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| week | Topic name | | LO | ID | | amount of hours | | Maximum score | | Form of Knowledge Assessment | | The  Form of the lesson  / platform |
| **Module 1.** Introduction to agricultural Biotechnology. Main approaches  **”** | | | | | | | | | | | |  |
| 1 | L1. Introduction to agricultural biotechnology. The aim of plant biotechnology. Basic direction in plant biotechnology. Cell technologies for receiving important BAS derived from plant material **”**. | **LO** 1 | | **ID** 1.2  **ID** 1.3  **ID** 1.1 | | 2 | |  | | ВС 1 | Video lecture | |
| Laboratory Work 1. (Lab 1.). Instruction of safety technique. Laboratory Manual/rules of lab work in laminar box, with autoclaves, PCR-thermo cycler, shaker, light setup | **LO** 2 | | **ID** 2.1.  **ID** 2.2 | | 2 | | 7 | | Analysis of the written report | Webinar  in MS Teams | |
| 2 | L.2. Micropropagation technologies of plants. Technology for production of virus-free plants | **LO** 2  **LO** 3 | | **ID** 2.1.  **ID** 2.3  **ID** 2.4..  **ID** 3.1  **ID** 3.2  **ID** 3.3  **ID** 3.5. | | 2 | |  | | ВС 2 | Video lecture | |
| Lab 2. Cultivation of mature wheat embryos in vitro on MS medium with different phytohormons | **LO** 1 | | **ID** 1.3 | | 2 | | 7 | | Analysis of the written report | Webinar  in MS Teams | |
|  | SIWT 1. Consultation and admission of Student Independent work with Teacher. Student Independent work (SIW) 3. Home tasks 1 titles шт the UNIVER system. |  | |  | |  | | 15 | |  | Distance learning" of the UNIVER system. | |
|  | \*\* Consultation on the implementation of CPC on the ZOOM platform. Completed SIW task  students send to the section "Distance learning" of the UNIVER system. | | | | | | | | | | | |
| 3 | L.3. Cell engineering of plants. cell selection | **LO** 1 | | **ID** 1.3 | | 2 | |  | | ВС 3 | Video lecture | |
| Lab 3. Somatic Embryogenesis Major components of medium for tissue Culture | РО 2 | | ИД 2.2 | | 2 | | 7 | | ТЗ 3 | in MS Teams | |
| The students send a summary of the laboratory work in the form of a file to the mail or to the section "Distance learning" of the UNIVER system.  Mandatory laboratory work is provided, according to the schedule in MS Teams | | | | | | | | | | | |
| 4 | L.4.Molecular cloning techniques. Selection of somatic hybrids: Strategies of biotechnology | **LO** 2  **LO** 3 | | **ID** 2.1.  **ID** 2.3  **ID** 2.4..  **ID** 3.1  **ID** 3.2  **ID** 3.3  **ID** 3.5. | | 2 | |  | | ВС 4 | Video lecture  in MS Teams | |
| Lab 4. Extraction DNA. Main principles.  <https://www.youtube.com/watch?v=yesNHd9h8k0>  <https://www.youtube.com/watch?v=gmNw6CWtN5k> DNA extraction  <https://www.youtube.com/watch?v=uB3xWX9FWlQ> | **LO** 2  **LO** 3 | | **ID** 2.1.  **ID** 2.3  **ID** 2.4..  **ID** 3.1  **ID** 3.2  **ID** 3.3  **ID** 3.5. | | 2 | | 7 | | Analysis of the written report | Webinar  in MS Teams \* | |
| 5 | L.5. Agrobacterium-mediated transformation in which the transfer-DNA (T-DNA) contained the coat protein genes from each of the two viruses Methods of fertilization in vitro. Haploid technology. Main steps of molecular cloning techniques and applications. | **LO** 1 | | **ID** 1.1.  **ID**.1.2. | | 2 | |  | | ВС 5 | Video lecture  in MS Teams | |
| Lab 5. Subcultivation of carrot calli tissue. Analysis first results of experiment N2. Use of Four media (PESI solid, MS liquid, MS solid and ASP-C-I solid medium) to induce callus from excised tissues. | **LO** 2  **LO** 3 | | **ID** 2.1.  **ID** 2.3  **ID** 2.4..  **ID** 3.1  **ID** 3.2  **ID** 3.3  **ID** 3.5. | | 2 | | 7 | | Analysis of the written report | Webinar  in MS Teams \* | |
| SIWT. Consultation and admission of Student Independent work with Teacher. Student independent work (SIW 2) 3. Home tasks 2 titles in the UNIVER system. | | | | | | | | | | | |
| **MC 1 100** | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| 6 | Methods of Agroinfiltration. Doubled haploidy technology | **LO** 1 | | **ID** 1.1.  **ID**.1.2. | | 2 | |  | | ВС 5 | Video lecture  in MS Teams | |
|  | Lab 6. Optimization of Agrobacterium-mediated Transient Protein Production in Nicotiana.  https://www.jove.com/v/51204/optimization-utilization-agrobacterium-mediated-transient-protein | **LO** 1 | | **ID** 1.1.  **ID**.1.2. | | 2 | | 5 | | ВС 5 | Video lecture  in MS Teams | |
| **Module 2. “**Microbial biotechnology**”** | | | | | | | | | | | | |
| 7 | L. 7. Microorganisms. Microbial biotechnology: fundamentals of applied microbiology (metabolism. control and monitoring of aseptic processing in biotechnology). | **LO** 1 | | **ID** 4.1 | | 2 | |  | |  | Video lecture  in MS Teams | |
| 7 | L.7. Utilization of Agrobacterium-mediated Transient Protein Production in Nicotiana  Prokaryotic cells in biotechnology production.  <https://www.youtube.com/watch?v=yesNHd9h8k0> | **LO** 1 | | **ID** 1.2 | | 2 | |  | |  | Video lecture  in MS Teams | |
|  | SIWT 3. Consultation and admission of Student Independent work with Teacher. Student independent work (SIW 2) 3. Home tasks 3titles in the UNIVER system. The task is carried out by a group of 2 students (report, presentation). | **LO** 1 | | **ID** 1.2  **ID** 1.5 | |  | | 7 | | Written assignment | Webinar  in MS Teams | |
|  | | | | | | | | | | | |
| 8 | L.8. Microbial Biotechnology in Foods and Agriculture Bioreactors, fermentation systems and metabolic pathways. inoculum, Production Media and Biomass Production in Microbial Biotechnology. Isolation of End Masses as Fermentation Products. | **LO** 1 | | **ID** 4.1 | | | 2 | |  |  | Video lecture  in MS Teams | |
| Lab 8. To know and learn: Biochemistry and physiology of growth and metabolism of microorganisms. Sterilization in biotechnology. types of sterilization, aseptic techniques.Investigation the potentials of isolated cultures from fermented products.  <https://www.youtube.com/watch?v=joPOWkjpinE>  <https://www.youtube.com/watch?v=avM1Yg5oEu0> microbial growth | **LO 1** | | **ID** 1.3,  4.1 | | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| 9 | L.9. Process management in Microbial Biotechnology: Genome management and analysis in microbial Biotechnology. Microbial process kinetics | **LO** 1 | | **ID** 1.3 | | | 2 | |  |  | Video lecture  in MS Teams | |
| Lab 9. Antibiotic susceptibility testing | **LO** 2 | | **ID** 1.3 | | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| SIWT 4. Consultation and admission of Student Independent work with Teacher. Student independent work (SIW 4) 3. Home tasks 4 titles in the UNIVER system. The task is carried out by a group of 2 students (report, presentation). | **LO** 1 | | **ID** 1.2  **ID** 1.5 | | |  | | 7 | Written assignment | Webinar  in MS Teams | |
| 10 | L.10. Measurement, monitoring, modelling and control in Microbial Biotechnology | **LO** 1 | | **ID** 1.3 | | | 2 | |  |  | Video lecture  in MS Teams | |
| Lab 10. Isolation the perspective cultures from soil. | **LO** 2 | | **ID** 1.3 | | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| **Midterm 100** | | | | | | | | | | | | |
|  | | | | | | | | | | |  | |
| 11  12 | **L.11.** Microbial Biotechnology in Chemical Industries | **LO** 1 | | | **ID** 1.3,  4.1 | | 2 | |  |  | Video lecture  in MS Teams | |
| **Lab 11.** Isolation the perspective cultures of microorganisms for bioremediation. | **LO** 4 | | | **ID** 4.1,  5.1 | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| **L.12.** Microbial Biotechnology in Medicine and Pharmaceutical Industries | **LO** 1 | | | **ID** 1.3  **ID** 4.1 | | 2 | |  |  | Video lecture  in MS Teams | |
| **Lab 12.** How to usethe perspective cultures of microorganisms in Medicine and Pharmaceutical Industries. | **LO** 4 | | | **ID** 1.2,  2.1 | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| **Module 3. “** Animal biotechnology | | | | | | | | | | | |
| **SIWT 5.** Consultation and admission of Student Independent work with Teacher. Student Independent work (SIW) 5. Topics: Research on animal cloning, achievements. Methods of embryo transplantation farm animals and their application. Gene transfer by using yeast artificial chromosomes. Home tasks 5 titles in the UNIVER system. The task is carried out by a group of 2 students (report, presentation). | **LO** 1 | | | **ID** 1.2  **ID** 1.5 | |  | | 7 | Written assignment | Webinar  in MS Teams | |
| 13 | **Lec. 13.** The main directions and tasks of modern animal biotechnology. Bioethics issues in animal biotechnology.Totipotency, multipotency, pluripotency of animal cells.Hormonal regulation of mammalianreproduction. Sexual cycles. | **LO** 1 | | | **ID** 1.3  **ID** 4.1 | | 2 | |  |  | Video lecture  in MS Teams | |
| **Lab 13.** Objects used in animal biotechnology. Rules for keeping and breeding animals in the laboratory conditions.Tissue- and time-specific gene expression. Cell differentiation. Ontogenesis of Drosophila, mice and cattle. Morphological and functional features of gametes - eggs and sperm. Meiosis. | **LO** 4 | | | **ID** 1.2,  2.1 | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| 14 | **Lec. 14.** Artificial insemination, In vitro fertilization, and embryo transfer in animals.Cryopreservation of gametes and embryos.Embryoengineering. | **LO** 1 | | | ИД 4.2 | | 2 | |  |  | Video lecture  in MS Teams | |
| **Lab 14.** Main stages of in vitro fertilization in animals. Allofennic animals (genetic chimera). Microsurgery of embryonic cells (morula, blastocyst) to create allofennic animals. Methods for assessment of the of the somatic cells, gametes and embryos viability. | **LO** 2 | | | **ID** 3.2,  5.1 | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| **SIWT 6.** Consultation and admission of Student Independent work with Teacher. Student Independent work (SIW) 5. Topics: Research on animal cloning, achievements. Methods of embryo transplantation farm animals and their application. Gene transfer by using yeast artificial chromosomes. Home tasks 6 titles in the UNIVER system. The task is carried out by a group of 2 students (report, presentation). | **LO** 4,5 | | | **ID** 4.3, 5.1 | |  | | 7 | ТЗ 13 | ZOOM\*\* | |
| 15 | **Lec. 15.** Animal genes cloning.Stem cells and the perspectives of practicalapplication. | **LO** 1 | | | **ID** 1.1 | | 2 | |  |  | Video lecture  in MS Teams | |
| **Lab 15.** Method of embryonic cloning. Cloning method using the somatic cell nuclear transplantation. Cloning amphibians. Cloning mammals. | **LO** 4 | | | **ID** 4.2, 5.1 | | 2 | | 5 | Analysis of the written report | Webinar  in MS Teams \* | |
| **MC 2** Questions |  | | |  | |  | | 15 |  |  | |
| **SIWT 7.** Consultation and admission of Student Independent work with Teacher. Student Independent work (SIW) 5. Topics: Research on animal cloning, achievements. Methods of embryo transplantation farm animals and their application. Gene transfer by using yeast artificial chromosomes. Home tasks 7 titles in the UNIVER system. The task is carried out by a group of 2 students (report, presentation). | **LO** 1, 4 | | | **ID** 1.3,  3.2 | |  | | 7 |  | ZOOM\*\* | |
| **MC 2 100** | | | | | | | | | | | | |

Dean of the Faculty \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ B.K.Zzayadan

Method bureau chairman\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_S.T. Nazarbekova

Head of department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A.S. Kustaubayeva

Lector \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .S.S. Kenzhebayeva