**SYLLABUS**

**Fall semester 2022-2023 academic years**

**on the educational program “***6B05103 Биотехнология, дневная, 4 Course*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Discipline’s code** | **Discipline’s title** | **Independent work of students (IWS)** | **Number of credits** | | | | | **Number of credits** | **Independent work of student with teacher (IWST)** |
| **Lectures (L)** | **Practical training (PT)** | | **Laboratory (Lab)** | |
|  | Safety of GMO and organic products |  |  |  | |  | |  |  |
| **Academic course information** | | | | | | | | | |
| **Form of education** | **Type of course** | **Types of lectures** | | | **Types of practical training** | | **Form of final control** | | |
| Full-time | daytime | presentation | | |  | |
| Lecturer | Prof. Kenzhebaeva S.S. | | | | | |  | | |
| e-mail | kenzhebss@gmail.com | | | | | |
| Telephone number |  | | | | | |

|  |  |  |
| --- | --- | --- |
| **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) |
|  | 1. to know the conceptual apparatus necessary for the successful development of the discipline. | 1.1. the concepts such as:"genetically modified organism (GMO)", "transgenic organism (TGO)”, “genetically modified source (GMI)”, “transgene”,"transgenesis", "genetic engineering", "molecular cloning",  "recombinant DNA", "transduction", "transformation" and others. |
| 2. to form a science-based socially responsible  relation to the problem of GMOs and orgaic products. | 2.1. to develop personal, professional and social competencies such as creativity, criticality, social responsibility.  2.2. Assessment of food safety in organic farming, organic principles and regulation  2.3. Putting the safety of organic food into perspective. synthetic agrochemicals, environmental pollutants, animal feeds and veterinary drugs |
| 3. to acquire fundamental knowledge about the nature of GMOs, methods and purposes of their creation; | 3.1. fundamental knowledge about the nature of GMOs, methods and purposes of their creation,  1.2. seach and analyze information about GMOs;  3.2. the assesmetn of the risks associated with the distribution and use of GMOs.  3.3. the personal, professional and social competencies such as creativity,  criticality, social responsibility. |
| 4 to know the purpose of issues for creation and use of GMOs, risks and biosecurity in connection with spread of GMOs in the world.  a) to give modern ideas about the goals and methods of creating GMOs;  b) show the risks associated with the cultivation of GMOs andusing products of their processing;  c) | 4.1. Modification of chemical composition in transgenic food  4.2 Improvement in technological and utility trends.  4.3. genetic transformation is alterations in functional traits, important in the technlogical and processing processes. |
| 5. to get knowledge of terms will form the basis for successful development subsequent topics of the studied disciplines, safety of GMO and organic products. | 5.1. the knowledge which will form the basis for successful development subsequent topics of the studied disciplines  5.2 the molecular biotechnology when creating GMOs, a person fundamentally changes the speed and the scale of such processes, which cannot but change the pace evolutionary process and lead to unpredictable results.  5.3. understanding that, molecular  technologies are not very accurate, reliable and security, terefore, the creation and use of GMOs generates biosecurity issue. |
| **Prerequisites** | general biochemistry, molecular biology, plant physiology,  microbiology, biotechnology, ecology. | |
| **Post requisites** | the formation of a scientific worldview and natural science picture of the world among Ms students. | |
| **Information resources \*\*** | **Literature:\*\***  1. Jose L. Domingo. Safety assessment of GM plants: An updated review of the scientific literature. Food and Chemical Toxicology. 2016, 95. 12-18  2. Marta Kramkowska 1Teresa Grzelak, [Krystyna Czyżewska](http://www.aaem.pl/Author-Krystyna-Czy%C5%BCewska/22196). Benefits and risks associated with genetically modified food products. Ann Agric Environ Med. 2013;20(3):413–419  3. William Freese1 and David Schubert. Safety Testing and Regulation of Genetically Engineered Foods. Biotechnology and Genetic Engineering Reviews – Vol. 21, November 2014.  4. Monica Garcia-Alonso. Safety Assessment of Food and Feed Derived from GM Crops: Using Problem Formulation to Ensure “Fit for Purpose” Risk Assessments. Collection of Biosafety Reviews Vol. 8 (2013): 72-101  5. Ingham B. Safety and practice for organic food. In New resources for nutrition educators book. 2020, 01, P. 754.  6. M.Piotrowska. Review Microbiological Decontamination of Mycotoxins: Opportunities and Limitations. Toxins 2021, 13, 819. https://doi.org/10.3390/toxins13110819  7.  **Internet resources:**  Internet resources (at least 3-5)  1. http://elibrary.kaznu.kz/ru  2. https://doi.org/10.1016/j.jneb.2020.01.013  3. http://www.plantdesigns.com/  4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4484336 | |

|  |  |
| --- | --- |
| **Academic policy of the course in the context of university moral and ethical values** | **Academic Behavior Rules:**  All students are required to register for the MOOC. The deadlines for completing the modules of the online course must be strictly observed in accordance with the schedule for studying the discipline. Leave in case of current MOOC or SPOC courses.  **ATTENTION!** Failure to meet deadlines results in loss of points! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the training course, as well as in the MOOC. Leave in case of current MOOC or SPOC courses.  **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 | Number of hours | Max.  score\*\*\* |
| **Module 1 Title** “Safety assessment of GMOs | | | |
| 1 | **Lec 1.** Introduction to the problem. conceptual apparatus of discipline andterminology used:"genetically modified organism (GMO)", "transgenic organism TGO)”, “genetically modified source (GMI)”, “transgene”,"transgenesis", "genetic engineering", "molecular cloning","recombinant DNA", "transduction", "transformation" | 1 |  |
| 1 | **Sem 1.** Food security is one of major concerns for the growing global population | 5 |  |
| 1 | **Lab 1.** Theme The molecular biotechnology used for creation GMOs.  Main principles of DNA genomic extraction. | 10 |  |
| 2 | **Lec 2.** Theme Transgenic crops- categorization |  |  |
| 2 | **Sem 2.** Theme The elements needed for the safety assessment of GM crops for animal feed purposes. |  |  |
| 2 | **Lab 2.** Theme Main principles of RNA genomic extraction |  |  |
| 2 | IWST 1. Consultation on the implementation of IWS1 on the topic:  1. The examples of GM crops related to tolerance to abiotic stress.  2. The examples of GM crops related to resistance to biotic stress (bacteria, fungus, virous).  3. GM crops with improved quality of products.  4. GM bacteria with use for human health.  5. GM animals with improved traits. |  | 20 |
| 3 | **Lec 3.** Theme Benefits and risks associated with genetically  modified food products |  |  |
| 3 | **Sem 3.** Theme: The current practice of safety assessment is  that the product would be subjected to, as the baseline. | 5 |  |
| 3 | **Lab 3.** Theme **3** Construction of recombinant DNA*.* | 10 |  |
| 3 | **SIW 1.** Topic, type of task.  Molecular characterization of GM crops,  Main methods and techniques.  Safety assessment of GM crops studies, such as toxicological, allergenicity, nutritional, and horizontal transfer |  |  |
| 4 | **Lec 4.** Theme Benefits resulting from genetic modification of food products |  |  |
| 4 | **Sem 4.** Theme Different breeding techniques and its requirement for safety assessment before commercialisation. | 5 |  |
| 4 | **Lab 4.** Theme: Methods for introducing recombinant DNA into a cell. | 10 |  |
|  | **IWST 2. Colloquium (test, project, essay, situational task, etc.).**  The topis is given for **SIW 1.** |  | 20 |
| 5 | **Lec 5.** Theme Modification of chemical composition in transgenic  food. |  |  |
| 5 | **Sem 5.** Theme Comparison of qPCR, ddPCR and NGS. | 5 |  |
| 5 | **Lab 5.** Theme methods of analyses of nucleic acids | 10 |  |
| **Module 2 Title .** Organic farming | | | |
| 6 | **Lec 6.** Theme: Improvement in technological and utility trends. |  |  |
| 6 | **Sem 6.** Theme: Sources of risks from the production and use of GMOs | 5 |  |
| 6 | **Lab 6.** Theme Pre and pos-marketing issues to be solve before GM crops commercialisation. | 10 |  |
| 7 | **Lec 7.** Theme: Safety Assessment of GM |  |  |
| 7 | **Sem 7.** Theme: Using RNA interference (RNAi)-based gene suppression mechanics | 5 |  |
| 7 | **Lab 7.** Theme Molecular Characterization of GMOs. Southern blot analysis and polymerase chain reaction (PCR) | 10 |  |
| 7 | IWST 3. Consultation on the implementation of the IWS 2. |  |  |
|  | **LEVEL CONTROL 1** |  | **100** |
| 8 | **Lec 8.** Theme: The key concepts of the relevant risks of food and feed. Modification of chemical composition in transgenic food. |  |  |
| 8 | **Sem 8.** Theme: Genetic modificatio or genome edited | 5 |  |
| 8 | **Lab 8.** Theme Molecular Characterization of GMOs. Polymerase chain reaction (PCR) in its various formats such as real-time PCR (qPCR). | 10 |  |
| 8 | **IWS 3.** Topic, type of task. Topic 1. Organic Agriculture.  Topic 2 Organic farming practices.  Topic 3 Process of organic farming practices  Topic 4. Organic farming techniques.  Topic 5. Effects of regulation of organic plant production.  Topic 6. Organic pesticides.  Topic 7. Microbiological hazards.  Topic 8. Animal feeds and veterinary drugs.  Topic 9. Advantages and disadvantages of organic agriculture and products. |  |  |
| 9 | **Lec 9.** Theme Nutritional and medical risks |  |  |
| 9 | **Sem 9.** Theme Production of therapeutic substances. | 5 |  |
| 9 | **Lab 9.** Theme Methods for studying genes expression | 10 |  |
| 10 | **Lec 10** Theme Environmental and agricultural risks |  |  |
| 10 | **Sem 10.** Theme Synthesis of toxic compounds | 5 |  |
| 10 | **Lab 10.** Theme: Molecular characterization of GM crops. Techniques for determination of alimentary cellulose, and pre- and probiotics | 10 |  |
| 10 | **IWST 4. Colloquium (test, test, project, essay, situational task, etc.). Topic, type of task.** |  | **20** |
|  | **Module 3 Title ..** **Organic principles and regulation.** |  |  |
| 11 | Lec 11 Theme Organic foods: Are they safer? More nutritious? |  |  |
| 11 | **Sem 11.** Theme What is organic farming? | 5 |  |
| 11 | **Lab 11.** Theme: A qPCR-based assay to quantify the copy number of transgenes. Methods of determination of vitamins A, C, E, plant pigments, indispensable unsaturated fatty acids (IUFA). | 10 |  |
| 12 | **Lec 12** Theme Difference between organic foods and their traditionally grown counterparts |  |  |
| 12 | **Sem 12.** Theme Risk of food allergy. | 5 |  |
| 12 | **Lab 12.** Theme Food additives in organic products | 10 |  |
| 12 | IWST 5. Consultation on the implementation of the IWS 3. |  | 20 |
| 13 | **Lec 13** Theme Assessment of food safety in organic farming |  |  |
| 13 | **Sem 13.** Theme Effects of regulation of organic plant production. | 5 |  |
| 13 | **Lab 13.** Theme Nutritional quality of organic food | 10 |  |
| 13 | *IWS 4*. Topic, type of task.  Topic 1. A ban on synthetic pesticides  Topic 2. A ban on synthetic mineral fertilisers  Topic 3. A ban on growth promoters.  Topic 4. Contaminant of nitrate in organic foods  Topic 5. Contaminant of Synthetic agrochemicals  Topic 6. Contaminant of environmental pollutants |  |  |
| 14 | **Lec 14** Theme: Effects of regulation on organic animal production |  |  |
| 14 | **Sem 14.** Theme Ban on pesticides | 5 |  |
| 14 | **Lab 14.** Theme Methods of determination of pesticides | 10 |  |
|  | **IWST 6. Colloquium (test, project, essay, situational task, etc.). Topic, type of task.**  The topics are givenfor **IWS 3.** |  |  |
| 15 | **Lec 15** Theme Effects of processing on organic production |  |  |
| 15 | **Sem 15.** Theme Agri-food system safety | 5 |  |
| 15 | **Lab 15.** Theme Contamination by microorganisms and mycotoxins | 10 |  |
| 15 | IWST 7. Consultation on examination issues |  | 20 |
|  | **LEVEL CONTROL 2** |  | **100** |

Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Head of Department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lecturer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_prof. Kenzhebayeva s.S.

**NOTE:**

The total volume of the syllabus is no more than 5 pages, font 10, Times New Roman

\* LO is based on cognitive (1-2), functional (2-3), systemic (1-2) competencies, total 4-7.

The types and number of competencies (out of 5) are compiled according to the level of education.

\*\* Give no more than 5-7 sources of literature (full bibliographic description), in depth for the last 10 years. (in exceptional cases, 20-30% of irreplaceable classical textbooks), for natural directions - 10 years. Humanitarian direction -5 years

Literature and resources:

1. Basic literature

2. Additional reading

3. Software

4. Internet resources

5. Professional databases

\*\*\*Spreading the assessment of students' knowledge is at the discretion of the compilers of the syllabus.

.