**SYLLABUS**

**Fall semester 2022-2023 academic years**

**on the educational program “**7M05109 *Биотехнология, дневная,*

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| **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)** | |
| **MMBT4311** | Modern methods of biotechnology |  |  |  | |  | |  |  |
| **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. | | | | | |  | | |
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| Telephone number |  | | | | | |

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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) |
|  | 1. to know the conceptual apparatus necessary for the successful development of the discipline and ares of use . | 1.1. define the use of modern methods of biotechnology in different areas of biotechnology with emphasis of modern techniquices |
| 2. to form a science-based socially responsible  relation to the problem of GMOs products. | 2.1. to develop personal, professional and social competencies such as creativity, criticality, social responsibility.  2.2. the knowledge of methods for study of cellular organells, their structure and functions, modification and interpretation of the results obtaining during biotechnology experiments, |
| 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,  3.2. contextualization of the different approaches and classify the processes of biotechnology and their regulations, discuss your results with them that are known,;  3  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 methods of molecular biology, their various  iosecurity 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 | Training courses, which must be mastered by students before studying this discipline: biology, chemistry, organic chemistry, botany’s, physics, molecular biology, plant physiology, microbiology, biotechnology apparatus and processes | |
| Postrequisites | Biotechnology, genomics, proteomecs | |
| Literature and resources | **Literature:**   1. Kenzhebayeva S.S. Modern methods in biotechnology. Алматы, Қаzақ University, 2011, 207 С. 2. Глик Б., Пастернак Дж. Молекулярная биотехнология. М.: Мир, 2002. - 589 с. 3. Калашникова Е.А., Кочиева Е.З., Миронова О.Ю. Практикум по сельскохозяйственно» биотехнологии. - М. :Колосс, 2006. - 144 с.   Е.I. Коndratenko, N.В. Netipanova I.А. Skvorthova, N.А. Lomteva, Т.В. Кuzina, С.К. Каsimova. Cytogenetical and molecular-biological methods of plants analysis. 2015 «Аstrahan University». 70С.   1. De Jong, R. Enzyme Free Cloning for high throughput gene cloning and expression / R. de Jong, M. Daniёls, R. Kaptein and G. Folkers // J. Struct. Funct. Genomics. — 2006. — V. 7. — P. 109–118. 2. Lee, J. High-throughput T7 LIC vector for introducing C-terminal poly-histidine tags with variable lengths without extra sequences / J. Lee and S. Kim // Prot. Expr. Purif. — 2009. — V. 63. — P. 58–61.   Nolting B. The newest methods of biosystems research. - М.: ТЕchnosphera, 2015. -256 p.  Епринцев  **Internet-resources:**  https://www.khanacademy.org/science/biology/cellular-molecular-biology/mitosis/a/cell-cycle-phases  http://plantphys.info/plant\_physiology/cellcycle.shtml  <http://www.britannica.com/EBchecked/topic/623731/vascular-system>  http://www.britannica.com/UpBeat-37879-Basic-Plant-Physiology-Parts-Flowering-Functions-Roots-Types-phy-Education-ppt-powerpoint.htm | |

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| **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**E** 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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| week | Topic name | Number of hours | Max.  score\*\*\* |
| **Module 1 Title** “Methods for sudy of cellelar structure” | | | |
| 1 | **L 1.**  «Itroduction. Practical use of modern methods in agriculture, industrial biotechnology, development of new products»  **Sem 1**. Advanced methods and techniques in plant science and biotechnology. Development of new products by using different modern approaches | 10 |  |
| 2 | **L. 2. «**Methods of differential centrifugation and their using. Methods of identification of subcellular fractions. Ultra centrifugation**».** |  |  |
| 2 | **Sem 2.** Theme Differential centrifugation and their using. Methods of identification of subcellular fractions The elements needed for the safety assessment of GM crops for animal feed purposes. |  |  |
| 2 | IWST 1. Consultation on the implementation of IWS1 on the topic:  1. Methods of determination of membranes lipides of cellular structures.  2. Identification of cellular structure on the base of marker enzymes.  3. Methods of determination of fatty acids membranes of of cellular structures.  4. Methods of determination of proteins membranes of cellular structures.  5. Use of transmission electron microscope for study of internal ultra structure of the cell organelles. |  | 20 |
| 3 | **L. 3.** «Modern methods in study cell membranes» |  |  |
| 3 | **Sem 3.** Theme: Crude Isolation of plant plasma membrane by differential centrifugation. | 5 |  |
| 3 | **SIW 2.** Topic, type of task.  Modern methods of determination of membrane stability. The methods of the structure and function of cell membranes. |  |  |
| 4 | **L. 4.** «Membranes and detergents. The method of solubilization of membranes. Use of detergents Use detergents in studycell membranes »  **Sem 4.** Determine selective protein precipitation methods*.* Describe factors affecting protein stability during isolation, purification. |  |  |
|  | **IWST 2. Colloquium (test, project, essay, situational task, etc.).**  The topis is given for **SIW 1.** |  | 20 |
| 5 | **Lec 5.** «Present types of biophysical methods on study of membrane structures. Basic principles of chromotography» |  |  |
| 5 | **Sem 5.** Theme Describe enzyme activity analysis by electrophoresis. Show use of preparative gel electrophoresis in protein study. Practical exercises will include: protocol of preparation of gel,  Reaction mix for determination of enzyme activity.  Calculation of molecular mass from SDS gels Describe methods in study of proteins separation according to distinct physical properties. | 10 |  |
| **Module 2 Title .** The methods of analyses of proteins. Proteomic methods. | | | |
| 6 | **Lec 6.** Theme: «Analysis and Characterization of Proteins» |  |  |
| 6 | **Sem 6.** Theme: Present principles of methods of protein assays. Describe methods in study of proteins separation according to distinct physical properties and proteins purification. | 10 |  |
| 7 | **Lec 7.** Theme: General strategy of protein purification». |  |  |
| 7 | **Sem 7.** Theme: Describe methods in study of proteins separation according to distinct physical properties. Show preparative gel electrophoresis in protein study.  Assignments for the CDS 3. Ion exchange chromotography. Gel exclution chromotography. High performance liquid chromotography (HPLC). Principles of isoelectric focusing (IEF) to separate proteins based on their isoelectric points Describe enzyme activity analysis by electrophoresis Show preparative gel electrophoresis in protein study. Calculation of molecular mass from SDS gels Describe methods in study of proteins separation according to distinct physical properties. Calculation of molecular mass from SDS gels in isoelectric focusing (IEF). Molecular Characterization of GMOs. Southern blot analysis and polymerase chain reaction (PCR). **Carry out type:** Presentation. | 10 |  |
| 7 | IWST 3. Consultation on the implementation of the IWS 2. |  |  |
|  | **LEVEL CONTROL 1** |  | **100** |
| 8 | **Lec 8.** Theme: **L 8.** «Main principles of electrophoresis». |  |  |
| 8 | **Sem 8.** Theme: Different typesofelectrophoresis and gel visualization. Consider the protocols for these methods. | 10 |  |
| 8 | **IWS 3.** Topic, type of task. Topic 1. Biomolecular inteactions: ligands binding and enzyme reactions.  Topic 2 Experimental measurements of ligands binding interactions.  Topic 3 Kinetic properties of enzymes.  Topic 4. The Bradford Protein Assay as an Example of Ligand  Binding.  Topic 5. Applications of an Enzyme Assay.  Topic 6. Significance of Kinetic Constants.  Topic 7. Agarose Gel Electrophoresis.  Topic 8. Protein Characterization  Topic 9. Determination of Primary Structure.  Topic 10. Polyacrylamide Gel Electrophoresis (PAGE);  Topic Discontinuous Gel Electrophoresis, Sodium Dodecyl Sulfate-Polyacrylamide Gel Electrophoresis, (SDS-PAGE),  Topic Nucleic Acid Sequencing Gels |  |  |
|  | **Module 3 Title.** *Molecular biology: Structures and analysis of nucleic acids* |  |  |
| 9 | **L 9.** Theme «Methods of nucleic acids isolation». |  |  |
| 9 | **Sem 9.** Theme DNA isolation from different biological organisms  *Assignments for the CDS 4.* Molecular methods of structural and functional organization of genes and genome | 10 |  |
| 10 | **Lec 10** Theme«Methods of DNA analysis. |  |  |
| 10 | **Sem 10.** Theme Main principles of RNA isolation from different biological organisms | 5 |  |
| 10 | **IWST 4. Colloquium (test, test, project, essay, situational task, etc.). Topic, type of task.** Methods for studying genes expression |  | **20** |
| 11 | **Lec 11** Theme L 11. «Modification of nucleic acids. |  |  |
| 11 | **Sem 11.** Different types of PCR. Determination optimal concentration of sample DNA, optimal concentration of primers, regime of PCR for amplification of PCR product | 5 |  |
| 12 | **Lec 12** Theme Methods of study genes expression» |  |  |
| 12 | **Sem 12.** Theme Types of real time PCR. Absolute and relative quantification of cDNA | 5 |  |
| 12 | IWST 5. Consultation on the implementation of the IWS 3. |  | 20 |
| 13 | **Lec 13** Theme «The use of DNA markers in molecular breeding |  |  |
| 13 | **Sem 13.** ThemeBasic principles and methods Genetic Engineering»  *Assignments for the CDS 5*. Methods of study of transcriptional factors and nucleic acids staining. Use of molecular markers in improvement of living organisms traits.  Topic: Production of Proteins by Expression of foreign Genes;  Gene Expression in Prokaryotic Organisms 317  Gene Expression in Eukaryotic Cells | 5 |  |
| 13 | *IWS 4*. Topic, type of task.  Topic 1. Molecular characterization of GM crops.  Topic 2. Important Enzymes in Molecular Biology and Biotechnology  Topic 3. Cloning Vectors.  Topic 4. Molecular Cloning  Topic 5. Steps for Preparing Recombinant DNA  Topic 6. Isolation of Plasmid DNA  Topic 7. Methods of studying the sequences of the nucleic acids fragments;  Topic 8 Comparison of qPCR, ddPCR and NGS. |  |  |
| 14 | **Lec 14** Theme: «The use of DNA markers in molecular breeding» |  |  |
| 14 | **Sem 14.** Theme Modern types of DNA markers used for in agriculture. | 10 |  |
|  | **IWST 6. Colloquium (test, project, essay, situational task, etc.). Topic, type of task.**  The topics are givenfor **IWS 3.** |  |  |
| 15 | **Lec 15** Theme Aproaches for genome editing |  |  |
| 15 | **Sem 15.** The applications of genome editing for improvement of valuable traits. Boundary control II.  *Assignments for the CDS 6.* Theme SNP marker, its using and , Mutation and genetic variation as modern approach, the use, advantage and disadvantage. Practical applications of induced mutagenesis | 10 |  |
| 15 | IWST 7. Consultation on examination issues |  | 20 |
|  | **LEVEL CONTROL 2** |  | **100** |

Dean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Zayadan B.K.

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

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

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