**SYLLABUS**

**Fall semester 2022-2023 academic years**

**on the educational program**
*6B05101 Биологическая инженерия, дневная, 2 course*

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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)** |
| **PhRZh2207 PHRZH 22121** | Plants and animals physiology  |  | 2 | 1 |  | 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 | Professionaldisciplines elective component |  | Laboratory works | In writing form | tests |
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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) |
| To acquaint students with the properties of the physiological, biochemical and molecular organization of plants, biochemical and physiological processes occurring in them, to show their relationship with environmental conditions. | 1. demonstrate knowledge about the properties of the physiological, biochemical and molecular organization of plants and metabolism of the most important compounds of plants; to form, substantiate, define the main topics of plant physiology, remember the mechanisms of main processes and their inteactions and importance during life activity, growth and development, demonstrate the knowledge of plant stress physiology | 1.1. know the features of the structural organization and properties of the main compounds synthesized by of plants during life activity;1.2. analyze the synthesis and biological functions of the most important plant cell compounds;1.3. finds a correspondence between the properties of compounds and their biological functions;1.4. demonstrates knowledge about the most important metabolic processes of a plants during growth and development;1.5. master knowledge фищге plant stress physiologyю 1.5. based on lecture material, laboratory lessona, information sources, can write biochemical reactions of various components |
| 2. to select and apply in practice modern methods of biochemical and physiological research for the qualitative and quantitative analysis of biological material; repeat and apply main methods used in different part of plant physiology, | 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 material, in accordance with methodological recommendations in accordance with safety regulations; |
| 3. to interpret the results of biochemical and physiological experiments, assessing the relationship between the structure of biomolecules and their physiological functions at the molecular level; interpret the results during obtaining experiments with plants, contextualize the different approaches and methods used in plant physiology | 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 structural and functional characteristics of the plant cell; describe the schemes used for characterization of main processes of plant physiology,  | 4.1 explain the means of main processes of plant cells and application, reformulate the conclusions obtained from experiments, argue another approach to study |
| 5. to analyze the features and importance of the main physiological processes of plants under normal conditions and under stress; discuss your results with them that are known,; apply the theoretical knowledge of plant physiology in different area of biology, select main factors regulating investigated process,  | 5.1 explain the mechanisms of key processes that occur in plant during growth and development 5.2 demonstrate theoretical knowledge and practical skills in plant physiology, illustrate your knowledge of plant physiology cells as their applications. |
| **Prerequisites** | **Cell biology, Botany,**  |
| **Post requisites** | Molecular Biology, Endocrinology, Agricultural biotechnology, Immunology |
| **Information resources**  | **Main:**1. Biochemistry and molecular Biology of Plants, 2nd Edition Bob B. Buchanan, (Editor), [Wilhelm Gruissem](http://eu.wiley.com/WileyCDA/Section/id-302479.html?query=Wilhelm+Gruissem) (Editor), [Russell L. Jones](http://eu.wiley.com/WileyCDA/Section/id-302479.html?query=Russell+L.+Jones) (Editor). 2015. 1280 p.
2. Медведев С.С. Физиология растений Учебник — СПб.: БХВ-Петербург, 2012. — 512 с.,
3. J. A. Bryant and D. Francis (2015). The plant cell cycle. Annals of Botany 107: 1063.
4. Atabayeva S., Kenzhebayeva S., Blavanchinskaya L. Stress physiology. ISBN978-601-04-1098-5. 2015, 84 p
5. Yakushkina N.I., Bakhtenko E.J. Plant physiology. 2018. 466 p.

**Additional:**Editors: **Segev**, Nava (Ed.) Trafficking Inside Cells Pathways, Mechanisms and Regulation 2009.Kristiina Himanen (2015). Cell cycle regulation during plant growth and development, Jörg D. Becker (2012) Decision- Making in the Plant Cell Cycle.Canal BQ-n.9.**Internet resources:** <https://www.goodreads.com/> https://www.khanacademy.org/science/biology/cellular-molecular-biology/mitosis/a/cell-cycle-phaseshttp://plantphys.info/plant\_physiology/cellcycle.shtmlhttp://www.britannica.com/EBchecked/topic/623731/vascular-systemhttp://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 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:**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| weeks  | Topic name | LO | ID | amount of hours  | Maximum score | Form of Knowledge Assessment  | TheForm of the lesson / platform |

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| Module **1**  |
| 1 | Lecture 1. Introduction to Plant physiology. Physiology of the plant cell Structure and functions of plant cell wall. | **LO** 1 | **ID** 1.1.**ID**.1.2. | 2 |  |  | Off line |
| 1 | Seminar 1. Plant cell structures, functions.  | **LO** 2  | **ID** 2.1.**ID** 2.2 | 2 | 10 |  | Off line |
| 2 | Lecture 2. Plant Water exchange of plant cell.Main mechanisms and their regulations  | **LO** 1 | **ID** 1.2**ID** 1.3**ID** 1.1 | 2 |  |  | Off line |
| 2 |  Seminar. 2 Mechanisms of cell water exchnage. Observing the cap plasmolysis | **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 | 10 | Analysis of the written report | Off line |
| 3 | Lecture 3. Mechanisms and regulations of water exchange of whole plant  | **LO** 1 | ID 1.1. | 2 |  |  | Off line |
| 3 | Seminar. 3 Study of the physiology of photosynthesis, its meaning. Light phase of photosynthesis Changes in the permeability of the cytoplasm under damage. | **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 | 10 | Analysis of the written report | Off line |
| 3 | IWSP 1 Consultation on the implementation of IWS1 |  |  |  |  |  |  |
| 3 | **IWST 1.** Topic: Physiology of plant cell The compositions and functions of main plant cell organoids. Answer test questions and presentations. | **LO** 1 | **ID** 1.2**ID** 1.5 |  | 15 | Written assignment |  |
| 4 | Lecture 4. Photosynthesis. Photosynthetic apparatus plants. Structure, functions, classification of main photosynthetic pigments | **LO** 1  | **ID** 1.2**ID** 1.3**ID** 1.1 | 2 |  |  | Off line |
| 4 | Seminar 4. Photosynthesis. Dark phase of photosynthesis. Determination of potential osmotic pressure of the cell sap by plasmolysis. | **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 | 10 | Analysis of the written report | Off line |
| 4 | SRSP2. Testing on theoretical material. | **LO** 1 | **ID** 1.2**ID** 1.5 |  | 10 |  | Off line |
| 5 | Lecture 5. Light stage of photosynthesis. Importance, structure, functions of photosystems I and II. | **LO** 1 | **ID** 1.1.**ID**.1.2. | 2 |  |  | Off line |
| 5 | Seminar 5. Photophosphorilation. Mitchel hypotesis. Extraction ofleaf pigments. Quantitative determination of the pigments. | **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 | 10 | Analysis of the written report | Off line |
| 5 | **IWST** 2 Topic: Plants water exchange at levels of whole plant, organs, cells. Answer questions in writing. Solving situational tasks. | **LO** 1 | **ID** 1.2**ID** 1.5 |  | 15 | Written assignment | Off line |
| 6 | Lecture 6. dark stage of photosynthesis. | **LO** 1 | **ID** 1.4**ID** 1.1 | 1 |  |  | Off line |
| 6 | Seminar. 6 the physiology of respiration in plants. The components of electron chain of respiration Photosensitizing effect of chlorophyll on the reaction of hydrogen transfer by Gurevich.. | **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 | 10 | Analysis of the written report | Off line |
| 6 | Testing on theoretical material. | **LO** 1  | **ID** 1.1.**ID**.1.2. |  | 10 |  | Off line |
| 7 | Lecture 7. Significance of respiration. Substrates of respiration | **LO** 1 | **ID** 1.4 | 2 |  |  | Off line |
| 7 | Seminar 7. Determination of respiration in a closed vessel | **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 | 10 |  | Off line |
|  | IWSP 2 Consultation on the implementation of IWS |  |  |  |  |  | Off line |
| 7 | SIWT 3 **Practical class 7.** Assignments for the CDS 3 on photosynthesis. Light and dark phases of photosynthesis. Factors affecting on these procuresses.Solving situational tasks. | **LO** 1 | **ID** 1.2**ID** 1.5 | 1 | 10 | Written assignment | Off line |
| 5 | **MT 1** | LО 1 | ID 1.1. |  | 100 |  | Off line |
| 8 | Lecture **8.** The main ways of respiratory substrate oxidation. Energy yield of respiratory | LО 1 | ID 1.1. | 1 |  |  | Off line |
| Lab **8.** Determination of peroxidase in the juice of potatoes | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
| 9 | Lecture **9.** The components ofelectron transport chain of respiration |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| 10 | Lecture 10**.** The importance of plant mineral nutrition | LО 1 | ID 1.1. |  |  |  | Off line |
| Lab **10.** Microchemical analysis of the plant ash | LО 5 | ID 5.1. | 2 | 10 | Analysis | Off line |
| 10 | **МТ (Midterm Exam)** | LО 1 | ID 1.1. |  | 100 |  | Off line |
| 11 | Lecture **11.** Significance of macro- and microelements in the plants growth and development | LО 1 | ID 1.1. | 2 |  |  | Off line |
| Lab **11.** Determination of amylase in early seedlings. | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
| 11 | **IWST 5 Consultation on the implementation of IWS 4**. Significance of of macro- and microelements. **Presentation of results of performance:** The written decision or situational problems. Home task  | LО 1 | ID 1.1. | 1 | 5 |  | Off line |
| 11 | **SIWT 5.** Physiological role ofof macro- and microelements  | LО 1 | ID 1.1. | 1 | 15 | Logic task |  |
| 12 | Lecture **12.** The growth and development of plants. Regulation of cell cycle | LО 1 | ID 1.1. |  |  |  | Off line |
| Lab **12.** Dependence of seed imbibition from the composition of seeds under the absorption of | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
| 13 | Lecture **13.** Planthormones. Types and mechanisms of actions. | LО 1 | ID 1.1. | 2 |  |  | Off line |
| 13 | Lab **13.** Effect of indolile acetic acid (IAA) on shoots and roots growth of wheat | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
| 13 | **IWST 7Consultation on the implementation of IWS7.** Planthormones. Regulation of plants growth and development. The main factors affecting on these procuresses. Mechanisms of plants adaptations to abiotic stresses | LО 1 | ID 1.1. | 1 | 15 | Problem task | Off line |
| 14 | Lecture **14.** Introduction on physiology of stress. Abiotic stresses. Overal mechanisn of adaptations | LО 1 | ID 1.1. | 2 |  |  | Off line |
| 14 | Lab **14.** Effect of indolile acetic acid (IAA) on shoots and roots growth of wheat, barley | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
| 15 | Lecture **15.** Plants adaptationmechanisms to biotic stresses | LО 1 | ID 1.1. | 2 |  |  | Off line |
| 15 | Lab **15.** Effect ofdifferent concentrations of salt and heavy metals on growth of cereal seedlings | LО 1 | ID 1.1. | 2 | 10 | Analysis | Off line |
|  | **Тест** | LО 1 | ID 1.1. |  | 15 |  |  |
|  | **MT 2** | LО 1 | ID 1.1. |  | 100 |  |  |

**Dean Zaydan B.**

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

**Lector** Kenzhebaeva S.S.

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.]