

SYLLABUS
 Fall semester 2023-2024 academic year
 Educational program 6B05103 Биотехнология НИИ, дневная,
 2 course (Spring)

6B05103 Биотехнология, дневная, 3 Курс (Осенний)

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
Physiology and biotechnology of PBP 4312	The number of IWS is 5	1		2		The number of IWST is 3. This is a teacher's guide for the preparation of the IWS

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control
Choose Offline/online/ hybrid	Selectable Component	Offline	Offline	Univer standart
Lecturer - (s)	Kenzhebayeva Saule Sagindykovna			
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Phone :				
Assistant - (s)				
e-mail :				
Phone :				

ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) *	Indicators of LO achievement (ID)
To acquaint students with the features of physiological basis of plants productivity and key physiological processes affecting crop plants productivity, to show their relationship with environmental conditions.	– 1. To demonstrate knowledge about the features of physiological basis of plants and key n and metabolism of the most important biological compounds of living organisms; the key processes occurring in the plant during growth and development, and their interaction, as well as the response of plants to adverse conditions.importance of increase in agricultural productivity in terms of optimisation of physiological processes affecting crop plants.	1.1. know the features of the structural organization and properties of the main classes of biological molecules; 1.2. analyze the biological functions of the most important cell compounds and the key mechanisms of plants during growth and development; 1.3. finds a correspondence between the properties of compounds and their biological functions; 1.4. demonstrates knowledge of the most important metabolic processes of a living organism 1.5. based on lecture material and information sources, can write * chemical formulas and reactions of various biological molecules, describe the mechanism of their biochemical and physiological action on a living organism
	2. to choose and apply in practice modern methods of biochemical and physiological research for the qualitative and quantitative analysis of biological material; and apply the basic methods used in various fields of plant physiology	2.1. conducts information search to solve 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

	<p>material, according to methodology recommendations in accordance with safety regulations.</p> <p>3. to interpret the results of biochemical and physiological experiments, evaluating the relationship between the structure of biomolecules and their physiological functions at the molecular level; interpret and analyze the results while conducting experiments with plants, contextualize the various approaches and methods used in plant physiology</p> <p>4. to demonstrate knowledge of the structural and functional characteristics of the plant cell; describe the schemes used to characterize the basic processes of regulation of plant physiological processes:</p> <p>5. analyze the features of the main physiological processes of plants under normal conditions and under different kinds of stresses (Drought, 2 Heat stress, cold stress, soil salinity and acidity stress floods, to apply theoretical knowledge of plant physiology in various fields of biology, determine the main factors that regulate the process under study.</p>	<p>3.1. fixes and draws up the results of experimental work in the required format (tables, graphs, diagrams, etc.)</p> <p>3.2. evaluates the correctness of the laboratory test;</p> <p>3.3. analyzes the data obtained during the experiment;</p> <p>3.4. compares the obtained data with the expected results, confirming the correctness of the experiment;</p> <p>3.5. makes final conclusions from the data obtained;</p> <p>4.24.1 explain the essence of the main processes of plant cells and their interaction, formulate conclusions obtained as a result of experiments, argue a different approach to the study</p> <p>5.1. explain the factors regulating the key processes occurring in the plant during growth and development,</p> <p>5.2 demonstrate theoretical knowledge and practical skills in plant physiology, show knowledge of the regulation of cell responses as their practical application.</p>
Prerequisites	Plant anatomy and morphology, Cytology and histology, Plants physiology	
Postrequisites	Regulation of physiological processes of plants productivity, Agronomy, Agriculture	
Learning Resources	<p>Literature: main,</p> <ol style="list-style-type: none"> 1. Mechanisms of Plant Growth and Improved Productivity Modern Approaches: Modern Approaches (Books in Soils, Plants, and the Environment) Edited by A. Basra, 2018 2. Plant Physiology: Photosynthesis, Transpiration, and Respiration 1. Nebraska University. 3. Atabayeva S., Kenzhebayeva S., Blavanchinskaya L. Stress physiology. ISBN978-601-04-1098-5. 2015, 84 p 4. Yakushkina N.I., Bakhtenko E.J. Plant physiology. 2018. 466 p. 5. Plants And Crop Productivity. Edit. Rajaram Choyal (Author) Random Publications, 2015 <p>Additional:</p> <p>Kristina 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.</p> <p>Atkin OK, Bloomfield KJ, Reich PB, et al. (2015) Global variability in leaf respiration in relation to climate, plant functional types and leaf traits. New Phytologist 2016: 614–636.</p> <p>Research infrastructure</p> <ol style="list-style-type: none"> 1. Laboratories and other locations where teaching and learning will take place 2. <p>Professional scientific databases</p> <ol style="list-style-type: none"> 1. 2. <p>Internet resources (at least 3-5)</p> <ol style="list-style-type: none"> 1. http://elibrary.kaznu.kz/ru 1. MOOC - video lectures, etc 2. Optimization of photosynthesis for sustainable crop production CABI Agriculture and Bioscience Full Text (biomedcentral.com) 3. https://doi.org/10.1016/j.envexpbot.2022.104950. 4. https://cmg.extension.colostate.edu/Gardennotes/141.pdf 5. https://cid-inc.com/blog/plant-respiration-its-importance-and-applications/ 6. https://www.hindawi.com/journals/ijg/2014/70159-6/#abstract 7. https://www.sciencedirect.com/science/article/pii/S_2666675820300175 8. 	

The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University. Documents are available on the main page of IS Univer.

Integration of science and education. The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWS, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments.

Attendance. The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points.

Academic honesty. Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control", "Instructions for the final control of the autumn / spring semester of the current academic year", "Regulations on checking students' text documents for borrowings".

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Basic principles of inclusive education. The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail Saule.Kenzhabaeva@kaznu.edu.kz [contacts](#) or via video link in MS Teams [enter a permanent link to the meeting](#).

Integration MOOC (massive open online course). In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule.

ATTENTION! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				Assessment Methods	
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system	Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment	
A	4.0	95-100	Great	<p>Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.</p> <p>Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.</p>	
A-	3.67	90-94			
B+	3.33	85-89	Fine	<p>Formative and summative assessment The teacher introduces his own types of assessment or uses the proposed option</p>	
B	3.0	80-84			
B-	2.67	75-79	Satisfactorily	Activity at lectures	5
C+	2.33	70-74		Work in practical classes	20
C	2.0	65-69		Independent work	25
C-	1.67	60-64		Design and creative activity	10
D+	1.33	55-59		Unsatisfactory	Final control (exam)

Software (optional)

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B	3.0	80-84	
B-	2.67	75-79	Satisfactory
C+	2.33	70-74	
C	2.0	65-69	Unsatisfactory
C-	1.67	60-64	
D+	1.33	55-59	

Assessment Methods	
Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment	
Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.	
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Formative and summative assessment The teacher introduces his own types of assessment or uses the proposed option	Points % content The teacher enters his score into points in accordance with the calendar (schedule). The exam does not change and the final score in the course
Activity at lectures	5
Work in practical classes	20
Independent work	25
Design and creative activity	10
Final control (exam)	40

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	Number of hours	Max. ball
MODULE 1 <i>Physiological processes in on plants</i>			
1	L 1. Theme Introduction to Plant physiology. Physiology of the plant cell. Structure and functions of plant cell wall.	1	0
	LC 1. Effect of anion and cation salts on the form and time of plasmolysis	2	10
	L.2 . Plant Water exchange of plant cell. Main mechanisms and their regulations. Mechanisms and regulations of water exchange of whole plant	1	0
	PC 2. Theme	2	10
	LC 2. Theme Observing the cap plasmolysis.	2	15
	IWS P 1. Consultations on the implementation of IWST 1 ATTENTION. Number of IWST (6-7), IWS (2-5) for 15 weeks Multitarget manipulation of photosynthetic carbon assimilation. Simultaneous manipulation of the Calvin-Benson cycle and photorespiration, Improving the efficiency of responses to the fluctuating light environment.	2	0
3	L 3. Theme Photosynthesis. Photosynthetic apparatus plants. Structure, functions, classification of main photosynthetic pigments. Dark phase of photosynthesis. Determination of potential osmotic pressure of the cell sap by plasmolysis.		
	PC 3 Theme	1	10
4	LC 3. Theme Changes in the permeability of the cytoplasm under damage		
	IWST 1. Control work, test, individual / group project, essay, situational task, testing, portfolio, etc. at the teacher's choice.	1	0
4	L 4. Theme . Significance of respiration. Substrates of respiration. Energy yield of respiratory		
	PC 4. Theme	2	10
5	LC 4. Theme Determination of relative turgidity and water deficit. to compare the indicators of the tension of the water regime in leaves of plants grown under various composition of Knopp Nutrient medium.	1	0
	L 5. Theme... The importance of plant mineral nutrition		
5	PC 5. Theme	2	10
	LC 5. Theme Extraction of leaf pigments. Quantitative determination of the pigments. Photosensitizing effect of chlorophyll on the reaction of hydrogen transfer ...		
MODULE 2 Title . Environmental factors affecting key precesses of plant physiology.			
6	L 6. Theme... The growth and development of plants. Plant hormones. Regulation of cell cycle	1	0
	PC 6. Theme...	2	10
	LC 6. Theme. Determination of respiration in a closed vessel. Determination of physiological parameters of plants related to respiration	1	15
	IWST 2. Consultations on the implementation of IWS 2 Drought Resistance by Engineering Plant Tissue-Specific Responses. Stomatal-Mediated Drought Responses. Cuticular Wax Production. Carbon Allocation. Root Traits. Transforming C3 crops into C4. Effects of climatic conditions on crops productivity. Heat stress	1	0
7	L 7. Theme Introduction on physiology of stress. Abiotic stresses. Overall mechanism of adaptations Major Traits Contributing to drought and salt tolerance		
	PC 7. Theme	2	10
	LC 7. Theme. Microchemical analysis of the plant ash. Midterm control 1	NT	
	IWST 2. Screening Techniques for Drought resistance in plants. Main photosynthetical parameters used for evaluation the tolerant genotypes	1	0
8	L 8. Theme Introduction on physiology of stress. Biotic stresses (pathogens). Overall mechanism of adaptations Major Traits Contributing to resistance to pathogens.		
	PC 8. Theme	2	10
	LC 8. Theme. Microchemical analysis of the plant ash. Midterm control 1	NT	
	IWST 2. Screening Techniques for Drought resistance in plants. Main photosynthetical parameters used for evaluation the tolerant genotypes		100
Midterm control 1			

D		L.O		50-54		Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.		Number of hours	Max. ball
A week		Topic name							
		MODULE 1 <i>Physiological processes in on plants</i>							
1		L 1. Theme Introduction to Plant physiology. Physiology of the plant cell. Structure and functions of plant cell wall.						1	0
		LC 1. Effect of anion and cation salts on the form and time of plasmolysis						2	10
		L 2. Plant Water exchange of plant cell. Main mechanisms and their regulations. Mechanisms and regulations of water exchange of whole plant						1	0
		PC 2. Theme							
		LC 2. Theme Observing the cap plasmolysis.						2	10
		IWS P 1. Consultations on the implementation of IWST 1						2	15
		ATTENTION. Number of IWST (6-7), IWS (2-5) for 15 weeks							
		Multitarget manipulation of photosynthetic carbon assimilation. Simultaneous manipulation of the Calvin- Benson cycle and photorespiration. Improving the efficiency of responses to the fluctuating light environment.							
3		L 3. Theme Photosynthesis. Photosynthetic apparatus plants. Structure, functions, classification of main photosynthetic pigments. Dark phase of photosynthesis. Determination of potential osmotic pressure of the cell sap by plasmolysis.						2	0
		PC 3 Theme							
		LC 3. Theme Changes in the permeability of the cytoplasm under damage						1	10
		IWST 1. Control work, test, individual / group project, essay, situational task, testing, portfolio, etc. at the teacher's choice.							
4		L 4. Theme . Significance of respiration. Substrates of respiration. Energy yield of respiratory						1	0
		PC 4. Theme							
		LC 4. Theme Determination of relative turgidity and water deficit. to compare the indicators of the tension of the water regime in leaves of plants grown under various composition of Knopp Nutrient medium.						2	10
5		L 5. Theme... The importance of plant mineral nutrition						1	0
		PC 5. Theme							
		LC 5. Theme Extraction of leaf pigments. Quantitative determination of the pigments. Photosensitizing effect of chlorophyll on the reaction of hydrogen transfer						2	10
		MODULE 2 Title . Environmental factors affecting key precesses of plant physiology.							
6		L 6. Theme... The growth and development of plants. Plant hormones. Regulation of cell cycle						1	0
		PC 6. Theme..							
		LC 6. Theme. Determination of respiration in a closed vessel. Determination of physiological parameters of plants related to respiration						2	10
		IWST 2. Consultations on the implementation of IWS 2 Drought Resistance by Engineering Plant Tissue-Specific Responses. Stomatal-Mediated Drought Responses. Cuticular Wax Production. Carbon Allocation. Root Traits. Transforming C3 crops into C4. Effects of climatic conditions on crops productivity. Heat stress						1	15
7		L 7. Theme Introduction on physiology of stress. Abiotic stresses. Overall mechanism of adaptations Major Traits Contributing to drought and salt tolerance						1	0
		PC 7. Theme							
		LC 7. Theme. Microchemical analysis of the plant ash. Midterm control 1						2	10
		IWST 2. Screening Techniques for Drought resistance in plants. Main photosyntetical parameters used for evaluation the tolerant genotypes						NT	
8		L 8. Theme Introduction on physiology of stress. Biotic stresses (pathogens). Overall mechanism of adaptations Major Traits Contributing to resistance to pathogens.						1	0
		PC 8. Theme							
		LC 8. Theme. Microchemical analysis of the plant ash. Midterm control 1						2	10
		IWST 2. Screening Techniques for Drought resistance in plants. Main photosyntetical parameters used for evaluation the tolerant genotypes						NT	
Midterm control 1								100	

Dean _____ Kurmanbayeva M.S.

Head of Department _____ Kistaybayeva A.S.

Lecturer _____ Kenzhebayeva S.S.