AL-FARABI KAZAKH NATIONAL UNIVERSITY
Faculty of Biology and Biotechnology
Department of Biotechnology
Department of Molecular Biology and Genetics

APPROVED by
Dean of Faculty
_____ **B.K. Zayadan**
"09" 07 2021

EDUCATIONAL-METHODICAL COMPLEX OF DISCIPLINE

OB 2212 "Basic of Biotechnology" /
"6B05101 - Biological Engineering"

Course	2
Semester	4
Number of credits	6
Lecture	15 hours
Seminar	15 hours
Laboratory	30 hours
IWST	7

Almaty 2021

Educational-methodical complex of the discipline is made by Akimbekov N.S., Ph.D., Acting Professor; Turasheva S.K., Ph.D., Associate Professor; Amirova A.K., Ph.D., Associate Professor

Based on the working curriculum on the educational program "Biological Engineering"

Considered and recommended at the meeting of the department of Biotechnology from "15" 06 2021, Protocol No.37

Head of department _____ A.S. Kistaubayeva

Considered and recommended at the meeting of the Department of Molecular Biology and Genetics
from "15" 06 2021, Protocol No.31

Head of department _____ A.V. Lovinskaya

Recommended by the methodological council of the faculty
on "19" 06 2021, Protocol No.18

Chairman of the methodological council of the faculty _____ S.T. Nazarbekova

SYLLABUS
Spring semester 2021-2022 academic years
on the educational program "Biological Engineering"

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)		
OB 2212	Basic of Biotechnology	98	15	15	30	6	7

Academic course information					
Form of education	**Type of course**	**Types of lectures**	**Types of practical training**	**Number of IWS**	**Form of final control**
	Theoretical	Problematic, analytical	Problem solving, situational tasks, video analysis	6	Written traditional Univer
Lecturer and practical trainer	Akimbekov S. Nuraly, Ph.D., Post.Doc., Assistant Professor.			According to the class timetable	
e-mail	kaznu.nur@gmail.com akimbekov.nuraly@kaznu.kz				
Telephone number	3773327				
Lecturer and practical trainer	Turasheva Svetlana Kazbekovna, Ph.D., Associate Professor			According to the class timetable	
e-mail	svetlana.turasheva@kaznu.kz				
Telephone number	3773334 (12-05)				
Lecturer and practical trainer	Amirova Aigul Kuzembayevna			According to the class timetable	
e-mail	aigul_amir@mail.ru				
Telephone number					

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 provide the basic knowledge and practical aspects of microorganisms, plant and animal cell culture and their applications in biosecurity, biotechnology, molecular biology, and environmental sciences.	**1.** To apply scientific method and good experimental design in scientific experiments, to understand and demonstrate good laboratory practice (GLP) and good manufacture practice (GMP).	**1.1.** Gain the basic knowledge in the field of biotechnology and related areas. **1.2.** Ability to apply knowledge in practice. **1.3.** Ability to compete, to be psychologically ready to change the type of their professional activity. **1.4.** Ready for the act rationally and independently, guided by evidence scientific-based conclusions. **1.5.** Describe observations/experience received from cognitive professional activities in the field of biotechnology.
	2. To characterize new discoveries in biotechnology, which have led to the outcome in the form of fundamental and applied research, to cover the foundation platform of microorganisms, plant and animal cell culture and their applications.	**2.1.** Gain the basic knowledge of research techniques that used in biology. **2.2.** Characterize the skills to use the equipment applying in the biotechnology. **2.3.** Name the modern requirements for biotechnology products. **2.4.** Create a strategy for the analysis of work processes and phenomena in the modern biotech industry. **2.5.** Ability to evaluate in all aspects of modern industrial and application microbiology. **2.6.** Ability to evaluate in all aspects of modern

		plant biotechnology and animal biotechnology
	3. To involve multidisciplinary areas, such as microbiology, biochemistry, genetic engineering, immunology, tissue culture and physiology, and many more along with engineering, which make biotechnology very challenging.	**3.1.** Demonstrate effective interviewing skills to obtain employment in the biotechnology industry. **3.2.** Maintain a lab notebook; describe correct standard operating procedures, good lab practice and other documentation required in a biotechnological lab. **3.3.** Demonstrate standard lab techniques such as pipetting and measurements (mass/ volume). **3.4.** Demonstrate proper use of lab equipment. **3.5.** Understand and apply techniques to conduct a self-directed job search.
	4. Synthesize, interpret and evaluate results and know the modern requirements for biotechnology of prokaryote and eukaryote;	**4.1** Be able to use modern information technologies for the search, collection, storage and processing of information. **4.2** Be able to demonstrate knowledge of the main objects, methods and principles used in biotechnology of prokaryote and eukaryote. **4.3** Be able to work in a team
	5. To form the skills related to the basic methods and technologies used in plant and animal biotechnology	**5. 1** Be able to demonstrate ability to own methods and techniques for studying biotechnological objects. **5.2** Be able to demonstrate knowledge of the main objects, methods and principles used in biotechnology **5.3** Be able to demonstrate knowledge about approaches and achievements of biotechnology;
Prerequisites	Low molecular biological substances, Microorganisms and viruses are the objects of biotechnology	
Post requisites	Environmental biotechnology, Food biotechnology, Industrial biotechnology.	
Information resources	**Literature:** 1. Moo-Young Murray (ed.) Comprehensive Biotechnology. 3rd edition. Pergamon, 2019. -4912 p. 2. Sangeetha J., Thangadurai D., Tanasupawat S., Kanekar P.P. (Eds.) Biotechnology of Microorganisms. Apple Academic Press, 2020. - 372 p. 3. Zayadan B.L., Dzhansugurova L.B., Turasheva S.K. Basics of Biotechnology. Textbook. - Almaty: Kazakh University, 2018. - 354 p. 4. Turasheva S.K. Basics of Biotechnology: Plant Biotechnology. Textbook. Almaty. 2016. -198 p. 5. Turasheva S.K. Applied aspects of plant biotechnology: a monograph. Almaty. 2019 (in English) 6. Animal Biotechnology. Technologies, Markets & Companies – Edited by Prof. K.K. Jain. Jain PharmaBiotech. A Jain Pharma Biotech Report. 2013. 215 p. **Internet sources:** http://elibrary.kaznu.kz/ru/ https://study.com/academy/lesson/what-is-biotechnology-definition-history-examples.html https://www.edx.org/course/the-science-and-business-of-biotechnology?index=product&queryID=00f7bdcd41964882a27dbd2a9f8dadcf&position=1 https://www.coursera.org/learn/industrial-biotech https://bmcmicrobiol.biomedcentral.com/	

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 kaznu.nur@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:

Weeks	Topic name	LO	ID	Unt of hours	Maximum score	Form of knowledge assessment	The form of the lesson / platform
Module 1: The fundamentals of microbial biotechnology							
1	**L.1.** Microbial Biotechnology: fundamentals of applied microbiology.	LO-1	ID-1.1.	1			Online https://teams.microsoft.com/l/channel/19%3aEYMD3wfPEhgt37Zb5q3IC5aZL4gbkCIMjzOEm_ZzxG1%40thread.tacv2/General?groupId=3fc85724-ce65-45f6-8ef7-3efdfcb547cd&tenantId=b0ab71a5-75b1-4d65-81f7-f479b4978d7b
	P.1. Inoculum, production media and biomass production in microbial biotechnology.	LO-1	ID-1.1. ID-1.2.	1	6	Task-oriented	Online
	Lab.1. Biochemistry and physiology of growth and metabolism of microorganisms.	LO-1	ID-1.3. ID-1.1.	2	10	Experimental aimed	Online
	IWS 1.	LO-2	ID-1.2. ID-1.4.		10	Logic task	Online
2	**L.2.** Introduction to Concepts and Technologies in Microbial Biotechnology.	LO-2	ID-1.2. ID-1.3.	1			Online
	P.2. Scientific, technical, and economic aspects of microbial products.	LO-1	ID-1.3. ID-1.4.	1	6	Task-oriented	Online
	Lab.2. Sterilization in Biotechnology. Types of sterilization. Aseptic techniques.	LO-2	ID-1.3. ID-2.1.	2	10	Experimental aimed	Online
3	**L.3.** Prokaryotic cells in biotech production.	LO-2	ID-1.3. ID-2.1.	1			Offline (according to class schedule)
	P.3. Investigation the potentials of isolated cultures from soil.	LO-2	ID 1.3.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.3. Isolation the perspective cultures from soil.	LO-2	ID-1.3. ID-2.1.	2	10	Experimental aimed	Offline (according to class schedule)
4	**L.4.** Fermentation Biotechnology: principles, processes, and products.	LO-2	ID-2.1.	1			Offline (according to class schedule)
	P.4. Isolation of end masses as fermentation products.	LO-3	ID-2.1. ID-2.2.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.4. Isolation the microbial cultures from fermented beverages.	LO-3	ID-3.3. ID-2.1.	2	10	Experimental aimed	Offline (according to class schedule)
	IWS 2.	LO-2	ID-2.3. ID-2.5.		10	Logic task	Offline (according to class schedule)
5	**L.5.** Bioreactors, fermentation systems and metabolic pathways.	LO-3	ID-3.1. ID-3.2.	1			Offline (according to class schedule)
	P.5. Investigation the potentials of isolated cultures from fermented products.	LO-2	ID-3.1. ID-2.4.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.5. Isolation the cultures from fermented products.	LO-3	ID-3.3. ID-3.1.	2	10	Experimental aimed	Offline (according to class schedule)
	IC 1.				100		
Module 2: The fundamentals of plant biotechnology							
6	**L.6.** The aim of Plant biotechnology. Basic direction in Plant biotechnology	LO-2	ID-2.1. ID-2.2.	1			Offline (according to class schedule)
	P.6. Plant cell culture as a subject of the Biotechnology	LO-3	ID-3.1. ID-2.4.	1	6	Task-oriented	Offline (according to

							class schedule)
	Lab.6. Instruction of safety technique. Laboratory Manual/rules of lab work in laminar box, with autoclaves, PCR-thermocycler, shaker, light setup	LO-3	ID-3.3. ID-3.1.	2	10	Experimental aimed	Offline (according to class schedule)
7	**L.7.** Biology of cultivated plant cells. Principles and methods of cultivation plant cells	LO-3	ID-3.1. ID-3.2.	1			Offline (according to class schedule)
	P.7. Morphogenesis and regeneration in plant cell culture. Cell technologies for receiving important BAS derived from plant material.	LO-4	ID-4.1. ID-4.2.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.7. Prepare solution of macro-, microelements, growth regulators	LO-4	ID-4.1. ID-4.3.	2	10	Experimental aimed	Offline (according to class schedule)
	IWS 3				10	Logic task	Offline (according to class schedule)
8	**L.8** Technologies, used for saving biodiversity and plant propagation in vitro	LO-3	ID-3.1. ID-2.6.	1			Offline (according to class schedule)
	P.8 Clonal propagation of rare and endangered plants. Cryopreservation	LO-2	ID-2.1. ID-3.5.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.8. Calculation of stock solutions concentration. Prepare of solid Murashige-Skoog (MS) medium	LO-4	ID-4.1. ID-4.3.	2	10	Experimental aimed	Offline (according to class schedule)
9	**L.9.** Technologies used in plant breeding programs	LO-3	ID-3.1. ID-3.3.	1			Offline (according to class schedule)
	P.9. Cell selection. Embryoculture. Methods of Fertilization in vitro. Haploid technology.	LO-4	ID-4.2. ID-3.5.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.9. Cultivation of carrot parenchyma tissue on MS medium in vitro	LO-2	ID-2.1. ID-2.3.	2	10	Experimental aimed	Offline (according to class schedule)
	IWS 4				10	Logic task	Offline (according to class schedule)
10	**L.10.** Bioengineering methods in plant biotechnology	LO-3	ID-3.4. ID-2.6.	1			Offline (according to class schedule)
	P.10. Cell and genetic engineering of plants	LO-4	ID-3.3. ID-4.1.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.10. Cultivation of mature wheat embryos in vitro on MS medium with different phytohormons	LO-2	ID-2.1. ID-2.6.	2	10	Experimental aimed	Offline (according to class schedule)
	MT				100		
Module 3: The fundamentals of animal biotechnology							
11	**L.11.** The main directions and tasks of modern Animal biotechnology. Bioethics issues in Animal biotechnology.	LO-2	ID-2.1. ID-2.2.	1			Offline (according to class schedule)
	P.11. Objects used in Animal biotechnology.	LO-3	ID-3.1. ID-2.4.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.11. Safety rules in Animal biotechnology laboratory.	LO-3	ID-3.3. ID-3.1.	2	10	Experimental aimed	Offline (according to class schedule)
12	**L.12.** Animal cell culture technology. Primary Culture. Subculturing. Cell line. Maintenance.	LO-3	ID-3.1. ID-3.2.	1			Offline (according to

							class schedule)
	P.12. Cell potency. Totipotency, multipotency, pluripotency of animal cells.	LO-4	ID-4.1. ID-4.2.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.12. Artificial insemination, In vitro fertilization, and embryo transfer in animals.	LO-4	ID-4.1. ID-4.3.	2	10	Experimental aimed	Offline (according to class schedule)
	IWS 3				10	Logic task	Offline (according to class schedule)
13	**L.13.** Cryopreservation of gametes and embryos. Guidelines for Cryopreservation. Freezing Medium. Cryopreservation Medium.	LO-3	ID-3.1. ID-2.6.	1			Offline (according to class schedule)
	P.13. Methods for assessment of the of the somatic cells, gametes and embryos viability.	LO-2	ID-2.1. ID-3.5.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.13. Protocol for Cryopreserving Cultured Cells.	LO-4	ID-4.1. ID-4.3.	2	10	Experimental aimed	Offline (according to class schedule)
14	**L.14.** Animal cloning. Stem cells and the perspectives of practical application.	LO-3	ID-3.1. ID-3.3.	1			Offline (according to class schedule)
	P.14. Cloning method using the somatic cell nuclear transplantation.	LO-4	ID-4.2. ID-3.5.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.14. Method of embryonic cloning.	LO-2	ID-2.1. ID-2.3.	2	10	Experimental aimed	Offline (according to class schedule)
	IWS 4				10	Logic task	Offline (according to class schedule)
15	**L.15.** Genetic transformation of animal somatic cells.	LO-3	ID-3.4. ID-2.6.	1			Offline (according to class schedule)
	P.15. The principles of genetic engineering in Animal biotechnology.	LO-4	ID-3.3. ID-4.1.	1	6	Task-oriented	Offline (according to class schedule)
	Lab.15 Methods of introducing the foreign DNAs into animal cells.	LO-2	ID-2.1. ID-2.6.	2	10	Experimental aimed	Offline (according to class schedule)
	IC 2.				100		

Abbreviations: L – lecture; P – practice, Lab. – laboratory, IWS – individual work of students; IWST – individual work of students with teacher; IC – intermediate control.

Dean of the faculty — Zayadan B.K.

Chairman of the Faculty Methodological Council — Asrandina S.Sh.

Head of the Departments — Kistaubayeva A.S.

Zhunusbaeva Zh.K.

Lecturers — Akimbekov N.S.
Turasheva S.K.
Amirova A.K.