NON-PROFIT JOINT-STOCK COMPANY
«AL-FARABI KAZAKH NATIONAL UNIVERSITY»

MODULE HANDBOOK

EDUCATION PROGRAMME

6B05102- Biology

CLUSTER A

Content

Purpose of education programme

The program is aimed at the formation of a Bachelor of natural Sciences with practical skills and competencies in the field of biology, able to work in research, environmental protection, sanitary-epidemiological and other institutions.

Learning outcomes

ON1 demonstrate ideas about the processes and phenomena occurring in animate and inanimate nature, their interconnection and interdependence; on the biodiversity of living organisms, the basic laws of evolution and functioning of living systems; about environmental principles of environmental management; about the role of biological laws in solving social problems; about the methods of cognition of nature, which are necessary for solving tasks when performing professional functions;
ON2 apply knowledge and understanding of the main areas of biological science: in botany, zoology, cytology and histology, anatomy and physiology of humans and animals, biology of individual development, biochemistry, genetics, microbiology, molecular biology, ichthyology, biophysics, ecology when performing professional activities;
ON3 demonstrate skills in the collection and preparation of scientific materials, processing the results of field and experimental research;
ON4 master the methods of microscopic, botanical, zoological, biochemical, immunological, neurophysiological, photobiological, chronobiological, embryological, genetic, molecular biological, physiological, biophysical, ecological, etc. Types of biological analysis and practice them in the conditions of scientific research activities;
ON5 plan and conduct experiments in laboratories of research institutes and educational institutions on biological objects in order to identify the mechanisms of their activity in accordance with international requirements and principles of bioethics;
ON6 to collect, process, interpret biological material in the field and in the laboratory using biostatistics methods;
ON7 analyze the scientific literature, write reviews, write abstracts, articles, report and defend the results of research at scientific conferences and public hearings in a reasoned way;
ON8 assess the quality and safety of biological, genetic and biotechnological products and manufactures obtained for compliance with GLP rules;
ON9 to carry out diagnostics, examination, monitoring of biological objects in the conditions of biological and biotechnological and other laboratories to solve environmental problems, control GMOs;
ON10 master the methods of biochemical, molecular genetic, cytological, histological, biophysical, chronobiological, neurobiological, immunological analysis for use in biomedical practice;
ON11 to take biological material (blood, smear, biopsy, etc.) for diagnostic studies in medical laboratories;
ON12 to be guided by methodological problems arising at the present stage of the development of science; to use individual creative abilities to solve research and

innovation tasks and to possess the skills of selecting reliable information for the implementation of professional activities.

Learning Objectives-Module Matrix

Module	Learning outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Module of social and cultural development												+
Instrumental module												+
Module Physical Training												+
Aspects of natural sciences												+
Plant structure		+	+									
Morphology of humans and animals		+	+	+								
Biodiversity of flora and fauna		+	+	+								
Biostatic methods of molecular biology	+	+			+	+		+	+			
Problems of biophysics							+			+	+	
Applied problems of biology				+		+				+	+	+
Ecology and ethics		+		+					+			+
Genetics and private physiology							+	+	+			+
Fundamentals of bioresource conservation		+	+	+								+
General questions of biology		+		+			+					+
Herbs of Kazakhstan		+	+		+	+					+	
Cell pathology and cell technology	+				+			+	+			+
Biology and ecology of animals					+	+	+			+	+	
Human and plant genetics		+			+	+				+	+	+
Physiology and biophysics of living systems	+			+						+		
Additional types of training(att)	+											+

Course structure

GENERAL EDUCATION DISCIPLINES	
OBLIGATORY COMPONENT	ELECTIVE COMPONENT
51	5
56	

CORE DISCIPLINES	
UNIVERSITY COMPONENT	ELECTIVE COMPONENT
94	18
112	

MAJOR DISCIPLINES	
UNIVERSITY COMPONENT	ELECTIVE COMPONENT
36	24
60	

TERM				
1	Module of social and cultural development & Instrumental module & Module Physical Training 25 ECTS		Aspects of natural sciences 9 ECTS	34
2	Instrumental module & Module Physical training 12 ECTS	Elective component **(1 of 5)** 5 ECTS	Aspects of natural sciences 9 ECTS	26
3	Instrumental module & Module Physical training 7 ECTS	Plant structure & Morphology of humans and animals & Biodiversity of flora and fauna 24 ECTS		31
4	Module of social and cultural development & Module Physical training 7 ECTS	Plant structure & Morphology of humans and animals & 22 ECTS		29
5	Biostatic methods of molecular biology 6 ECTS	Applied problems of biology Ecology and ethics **(1 of 6)** 6 ECTS	Genetics and private physiology 18 ECTS	30
6	Biostatic methods of molecular biology 9 ECTS	Applied problems of biology Ecology and ethics **(2 of 6)** 12 ECTS	Genetics and private physiology 9 ECTS	30
7	Problems of biophysics	Fundamentals of bioresource conservation	General questions of biology Herbs of Kazakhstan Cell pathology and cell technology Biology and ecology of animals Human and plant genetics	36

	6 ECTS	6 ECTS	Physiology and biophysics of living systems **(3 of 18)** 24 ECTS		

8	Professional practice 9 ECTS	Professional (pre-diploma)practice 3 ECTS	**FINAL ATTESTATION** 12 ECTS	24

- **List of modules**
- Workload HPW (Hours per week) according – Teaching methods as lecture, seminar, lab works and others (lesson, project, etc.)

Modul / Disciplines	**ECTS**	**Workload HPW**				**Term**
		lec.	**sem.**	**lab.**	**other**	
Module of social and cultural development	**18**					
Modern historyofKazakhstan	5	1	2			1
Philosophy	5	4	2			1
Module of socio-political knowledge (Sociology, political science, Culture, Psychology)	8	1	2			4
Instrumental module	**25**					
Information and Communication Technologies	5		3			1&2
ForeignLanguage	10		3			1&2
Kazakh (Russian) Language	10	2		1		3
Module Physical Training	**8**					
Physical Training	8					1-4
Elective component (1 of 6)	**5**	1	2			2
al-Farabi and modernity						
Abai 's Teaching						
Legal bases of corruption control						
Ecology and Human Life Safety						
Entrepreneurship						
Scientific Research methods						
Aspects of natural sciences	**18**					
Zoology of invertebrates and lower plants	9	3		6		1
Chemistry and Mathematics	6	1,5		4,5		2
Professional (educational field) practice	3				3	2
Plant structure	**15**					
Biochemistry	6	1,5	1,5	3		3
Plant anatomy and morphology	9	3	6			4
Morphology of humans and animals	**18**					
Cell Biology and histology	9	3	1,5	4,5		3
Microscopic technique and human and animal anatomy	9	3	3	3		4
Biodiversity of flora and fauna	**13**					
Vertebrate Zoology and higher plants	9	3		6		3
Professional Practice	4				4	4
Biostatic methods of molecular biology	**15**					
Biostatistics	6	1,5	1,5	3		5
Molecular Biology	6	1,5	1,5	3		6
Professional Practice	3				3	6
Biophysics	**15**					
Biophysics	6	1,5	1,5	3		7
Professional Practice	9				9	8
Applied problems of biology	**18**					
Microbiology	6	3		3		6
Biology of individual development	6	3	1,5	1,5		5
Bioethics and radiation biology	6	3		3		6

Ecology and ethics	**18**					
Ecology of microorganisms	6	3	1,5	1,5		6
Human ontogenesis	6	3	1,5	1,5		5
Environmental ethics and the impact of physical fields on a living organism	6	3	1,5	1,5		6
Genetics and private physiology	**27**					
Genetics	9	3	6			5
Human and animal physiology	9	3	6			5
Chronobiology, Neurophysiology and Immunology	9	3	6			6
Fundamentals of bioresource conservation	**9**					
Bioresources of Kazakhstan	6	3	3			7
Professional Practice	3				3	8
General questions of biology	**24**					
Plant ecology and theory of evolution	9	3	6			7
Photobiology and differentiation of cells	9	3	6			7
Fundamentals of general parasitology	6	3	3			7
Herbs of Kazakhstan	**24**					
Introduction of plants	9	3	3	3		7
Basics of general mycology	9	3	3	3		7
Herbal medicine	6	3	3			7
Cell pathology and cell technology	**24**					
Private Histology	9	3	3	3		7
Cellular and tissue pathology	9	3	3	3		7
Stem cell biology	6	3	3			7
Biology and ecology of animals	**24**					
Fish Biology	9	3	3	3		7
Biology and ecology of mammals	9	3	3	3		7
Biology and ecology of insects	6	3	3			7
Human and plant genetics	**24**					
Phytopathology	9	3	3	3		7
Human genetics	9	3	3	3		7
Cytogenetics	6	3	3			7
Physiology and biophysics of living systems	**24**					
Physiological and biophysical mechanisms of adaptation and kinetics of drugs	9	3	3	3		7
Growth physiology and endocrinology	9	3	3	3		7
Special practical work on physiological and biophysical methods of research	6	3	3			7
FINAL ATTESTATION					12	8
TOTAL	**240**					

GENERAL EDUCATION DISCIPLINES
Obligatory component

Module of social and cultural development

1. conduct a critical-comparative and retrospective analysis of individual phenomena and events of the historical past with a common paradigm of the world-historical development of human society based on the new positions of modern Kazakhstan;
2. form own opinion on the modernization of Kazakhstani society, acquire historical knowledge to determine the objectivity of events taking place in modern Kazakhstan and the world community.
3. substantiate the role and importance of key worldview concepts as values of social and personal being of a person in the modern world
4. explain the social and ethical values of society as a product of integration processes in the systems of basic knowledge of the disciplines of the socio-political module;
5. well-argue and ground provide information about the different stages of development of the Kazakh society, political programs, culture, language, social and interpersonal relations;
6. analyze the features of social, political, cultural, psychological institutions in the context of their role in the modernization of Kazakhstani society;
7. assess the specific situation of relations in society from the standpoint of a particular social and humanitarian type of science, to design development prospects taking into account possible risks;
8. correctly express and reasonably defend their own opinions on issues of social significance.

Discipline designation	**History of Kazakhstan**
Credit points	*5*
Semester(s) in which the discipline is taught	*1*
Relation to curriculum	OBLIGATORY *Module of social and cultural development*
Teaching methods	Lecture, seminar, project
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the discipline	**Khassanayeva Leila,** *Senior Lecturer of Department of History of Kazakhstan, Candidate of Historical Sciences*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	The history of Kazakhstan and World history in the scope of the program of general secondary education and technical and professional education
Discipline objectives/intended learning outcomes	- To know the main historical facts and events of the history of Kazakhstan and analyze their features. - To explain historical phenomena and systematize knowledge on different periods of the history of Kazakhstan. - To understand the role of the history of Kazakhstan in the system of humanitarian knowledge and in the development of Turkic civilization. - To compare the achievements of modern historical science and analyze archival documents and materials.

	- To compare historical events in the history of independent Kazakhstan and analyze the challenges and threats of the modern world. - To reveal the role of history in the spiritual development of the people of Kazakhstan and to analyze the civilizational path of the country's development in different eras. - To analyze the content of Kazakhstan's modernization and describe the process of becoming an independent Kazakhstan. - To know the originality of innovations and to analyze Kazakhstan's development path. - To understand the essence of the transformations in New Kazakhstan and predict the prospects for the development of the Republic of Kazakhstan. - Draw up projects, write essays, develop your own position on the development of the Republic of Kazakhstan in the world community.
Content	Introduction. Aims and objectives of the course "History of Kazakhstan". Periodization of the history of Kazakhstan. Sources on the history of the early Turks. The problem of the origin of the Turks. The Great Steppe in the period of the Golden Horde (13th-15th centuries). Formation of the Kazakh state. The culture of the Kazakh people. Kazakhstan in the era of modern times: new methodological trends in the study. Kazakhstan in the context of Russian policy: administrative reform. The Alash movement and the idea of a nation state. Kazakhstan in the years of civil and political confrontation. Contradictions and Consequences of Soviet Reforms in Kazakhstan in the Second Half of the 20th Century. The policy of perestroika in Kazakhstan. Proclamation of Independence of Kazakhstan and the State system of the Republic of Kazakhstan. Socio-political and spiritual development of the Republic of Kazakhstan
Examination forms	State Examination - Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	1. History of Kazakhstan (Kazakh Eli): a manual of 4 books. Book 4: Independent Kazakhstan: Prerequisites for education, formation and development / T.O. Omarbekov, G.B. Khabizhanova, N.D. Nurtazina [et al.]. – Almaty: Qazaq University, 2021. -226 p. 2. History of Kazakhstan (Kazakh Eli): a manual of 4 books. Book 3: Kazakhstan under the conditions of colonial and totalitarian system/ T.O. Omarbekov, G.B. Khabizhanova, N.D. Nurtazina [et al.]. – Almaty: Qazaq University, 2021. -372 p. 3. History of Kazakhstan (Kazakh Eli): a manual of 4 books. Book 2: Kazakhstan in the XIII century - in the first quarter of the XVIII century. / T.O. Omarbekov, G.B. Khabizhanova, N.D. Nurtazina [et al.]. – Almaty: Qazaq University, 2021. -295 p. 4. History of Kazakhstan (Kazakh Eli): a manual of 4 books. Book 1: The territory of Kazakhstan from antiquity to the beginning of the XIII century. / T.O. Omarbekov, G.B.

	Khabizhanova, N.D. Nurtazina [et al.]. – Almaty: Qazaq University, 2021. -310 p. 5. O.I. Issenov. A.I. Kudaibergenova. Famine and evacuation in Kazakhstan (late 1920s-early 1930s) // Journal of history. – Almaty, No3 (106). 2022. 145-157 pp. 6. Allen J. Frank. Kazakh Muslims in the Red Army, 1939-1945. – Leiden/Boston: Brill, 2022. – 216 p.

Discipline designation	***Philosophy***
Credit points	*5*
Semester(s) in which the discipline is taught	*4*
Relation to curriculum	OBLIGATORY *Module of social and cultural development*
Teaching methods	Lecture, seminar, practice, project
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the discipline	***Shyngysbayev Lesken**, Senior lecturer of the Department of Political Science and Political Technologies, PhD* ***Zhunusova Aigerim**, Senior lecturer of the department of political science and political technologies*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	*Prerequisites:* Module of socio-political knowledge, History of Kazakhstan *Post requisites:* History and philosophy of science
Discipline objectives/intended learning outcomes	***Knowledge base***: The course is aimed at developing a holistic understanding of philosophy as a special form of knowledge of the world, about its main sections, problems and methods of studying them in the context of future professional activity. ***Analysis***: analyze the philosophical aspect of media texts, socio-cultural and personal situations to justify and make ethical decisions; ***Synthesis:*** develop and assert its own scientific position to use knowledge of the principles, laws and categories of philosophy in the process of solving professional problems ***Evaluation:*** Critical analysis, evaluation and synthesis of the new and complex ideas of contemporary philosophy; ability to evaluate and compare various theoretical concepts in the field of research and draw conclusions; ***Application:*** Productively apply your knowledge of human nature to problems in any other areas of philosophy. ***Application of skills***: conduct research that is relevant to identify the philosophical content of problems in the professional field and present the results for discussion. ***Autonomy in skill use***: demonstrate the ability to work independently, within limited time, and without access to external sources, to complete the specified task;

Content	The emergence of a culture of thinking. The subject and method of philosophy. Consciousness, soul and language. Being. Ontology and metaphysics. Cognition and creativity. Education, science, engineering and technology. Person. Life and death. Meaning of life. Ethics. Philosophy of values. Philosophy of freedom. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. Philosophy of new Kazakhstan
Examination forms	Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	• Ivin, A.A. Philosophy: a textbook for academic undergraduate studies / A. A. Ivin, I. P. Nikitina. - Moscow: Yurayt Publishing House, 2022. - 478 p. (Russian) • Petrov V.P. Philosophy: textbook / Petrov V.P. - Moscow: IP Ar Media, 2022. - 584 p. — ISBN 978-5-4497-1597-5. - Text: electronic // IPR SMART: [website]. — URL: https://www.iprbookshop.ru/121135.html (Russian). • Gabitov T.Kh. et al. Philosophy. - Almaty: Lantar Trade, 2019. - 380 p. Astana, 2018 (Kazakh) • Gabitov T.Kh. et al. Kazakh philosophy. - Almaty: Lantar Trade, 2019. - 206 p. (Kazakh) • Myrzaly S. Philosophy / S. Myrzaly - Almaty: "Bastau", 2014 - 424 p. (English) • Johnston D."A Brief History of Philosophy: From Socrates to Derrida". –A&C Black, 2016/ Astana, 2018 (Russian, Kazakh, English)

Module designation	**Sociology**
Credit points	2
Semester(s) in which the module is taught	1
Relation to curriculum	Obligatory component *Module of social and cultural development*
Teaching methods	lecture, seminar (case-study, discussion)
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 15 Contact hours. 5 hours per semester for Seminar, total 5 Contact hours 40 *self-study hours*
Person responsible for the module	***Abdikerova Gulnapis Orynbasarovna**, Professor of the Department of Sociology and Social Work, Doctor of Sociological Sciences* ***Morozova Tatyana Anatolievna**, Senior lecturer of the Department of sociology and social work, Candidate of sociological science* ***Shedenova Nazym Utegalievna**, Associate Professor of the Sociology and Social Work, Doctor of Sociological Sciences*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	--

Module objectives/intended learning outcomes	**<u>Knowledge and Understanding</u>** ***Knowledge base***: interpret the basic categories of sociology: social groups, institutions, structures, processes, etc.; determine the interrelation between the theoretical and empirical level of sociology, macro- and micro- approaches; to contextualize basic sociological ideas based on reading sociological works, highlighting local and global trends in the development of modern society. ***Ethical issues***: aware of ethically standards and cultural competence of social interaction and sociological research. Comply with the norms of behavior in accordance with the corporate culture of the university ***Disciplinary methodologies:*** Characterize types of design and methodologies of sociological research applicable in designing and conducting a sociological research. **<u>Cognitive/Intellectual skills</u>** ***Analysis***: Analyze the features and interrelation of social processes (socio-economic, political, cultural) and social institutions from the position of a sociological perspective and the value system of Kazakhstani society. Analyze the dynamics, changes and functions of social institutions (family, state, education, religion, market and others) in modern society. Analyze social development programs of Kazakhstani society. Analyze the collected social information in a scientific report and presentation. ***Synthesis:*** Determine the interrelation between the theoretical and empirical level of sociology, macro- and micro- approaches. Summarize information on trends in the development of social structures, individual and family, economy, education, culture, religion, social communications and globalization based on comparative research. Contextualize basic sociological ideas based on reading sociological works, highlighting local and global trends in the development of modern society. ***Evaluation:*** Identify the interrelation of social and personal problems to understand the features of social reality. Illustrate the role of social values, norms in the integration of social groups and society as a whole Compare trends in the development of social groups, structures and institutions in a local and global perspective Analyze social development programs of Kazakhstani society Discuss recommendations, solutions of social problems and situations based on social and ethical values. Develop proposals to improve situations in the social, political, cultural, economic spheres **<u>Practical skills</u>** ***Application:***

	Choose the appropriate tools for solving social problems and situations in own professional fields based on socio-ethical values. Formulate an urgent problem, the goal and objectives of the research. Compose a sociological research program (problem, tasks, hypotheses, concepts, etc.) to justify the choice of the method and sample of the research Develop research tools for analyzing a specific social problem. Develop a roadmap, models for solving social problems ***Application of skills***: apply methods and technologies in sociological researches, use categories of sociology, trends in the development of society on the basis of sociological macro- and micro-theories and concepts ***Autonomy in skill use***: express your own opinion, justify it with different approaches. act with high degree of autonomy and reflectively, regarding the important bases of sociological knowledge. ***Technical expertise*** Has technical expertise, performs smoothly with precision and effectiveness. Use of modern information technologies (computer, smartphones, projectors, etc.) Be able to find information by keywords on the Internet.
Content	Sociology in the understanding of the social world. Introduction to the sociological theory. Sociological research. Social structure and stratification. Socialization and Identity. Family and modernity. Youth and society. Religion, culture and society. Sociology of ethnicity and nation. Education and social inequality. Mass-media, technologies and society. Economy, globalization and labor. Health and medicine. Population, urbanization and social movements. Social changes: newest sociological discussion
Examination forms	The form of the exam is testing in the university system. The exam program defines the evaluation criteria. Test form is include single (1 of 5) and multi choice (2 or 3 of 8) options.
Reading list	1. Little W. Introduction to Sociology: 2nd Canadian Edition. Open Texbook Collection, 2016. Available online: https://opentextbc.ca/introductiontos 2. OpenStax College Authors Introduction to Sociology: 2nd ed. CNX, 2017. Available online :https://cnx.org/contents/r-QzKsl_@17.1:KZMdiUko@13/Preface-to-Introduction-to-Sociology 3. Ritzer G., Stepnisky J. Sociological Theory. – Los Angeles: Sage, 2018. – 802p. 4. Macionis J.J. Sociology. Global Edition. 16th edition. Pearson, 2017. – 744p 5. Macionis J.J. Society: The Basics. 14 edition - New Jersey. Pearson Education International, 2016. – 566p. (available online) 6. Brinkerhof D., White L.K., Ortega S., Weitz R. Essentials of Sociology. (In kazakh). 9 edition. Almaty: National bureau of translation, 2018 – 464. 7. Glotov, M. B. Sociology / M.B. Glotov. - M.: Bustard, 2020. - 400 p. 8. Demina L. A., Malyukova O. V., Buchilo N. F. Philosophy. Textbook. — M.: Prospect. 2020. 360 p.

	9. Bespalov, A.M., Prudnikova, M.M. Sociology [Text]: Electronic educational institution / A.M. Bespalov, M.M. Prudnikova; Altai State University.-ped. un - t em. S.M. Shukshin. - Biysk: S.M. Shukshin AGSPU, 2020-4,28 MB. –328 p.

Discipline designation	*Cultural studies*
Credit points	2
Semester(s) in which the discipline is taught	1
Relation to curriculum	Obligatory Component Module of social and cultural devolopment
Teaching methods	lecture, seminar, discussion, case study
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *0,5 hours per week for Seminar, total 5 Contact hours* *40 self-study hours*
Person responsible for the discipline	***Mailykutova M.D** Senior Lecturer* ***Berikbayev E.G.** Senior Lecturer* ***Abisheva A.K.** Doctor of Philosophy, docent*
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the module	SIK 1101 Modern history of Kazakhstan FIL 2102 Philosophy
Discipline objectives/intended learning outcomes	• describe the features of the organization and functioning of political institutions (institutions of representation and coordination of interests); • demonstrate an understanding of the mechanisms and principles of the functioning of political power, political institutions, internal, external, world politics and international relations; • demonstrate an understanding of the essence and laws of the functioning and development of politics, its role in various spheres of society's life; • justify the interconnection of political systems and political regimes; • evaluate the degree of objectivity of political information from different sources, to give reasoning for expressing one's civil position, to evaluate facts, events, phenomena on the basis of analysis of the political strategy and national interests of modern states; • describe the morphology and anatomy of culture as a system of parameters and forms in contexts: nature, man, society; • explain the origin and essence of signs, meanings, archetypes, symbols as a system of cultural code through correlation with the type of material culture, a certain way of being; • to classify the cultural capital of the Prototurks, Turks, to regulate the forms and channels of cultural interactions with the peoples of Western Europe, the Middle East, to reveal their contribution to the intellectual and cultural history of mankind and the Kazakh people;

	• provide reasonably and justifiably information on the various stages of the development of Kazakh culture as a factor in the preservation of the cultural heritage and the Kazakh language, including modern state programs for its development and modernization • reasonably and reasonably provide information on various stages of development of Kazakh culture as a factor in the preservation of cultural heritage and the Kazakh language, including modern state programs for its development and modernization - Understand the role and place of psychological knowledge in the system of human sciences; - describe the concepts of *personality and interpersonal communication* in the context of the formation and modernization of national consciousness; - Use psychological knowledge for career planning and building a professional path; - Assess your own psychological qualities, resources and opportunities - To analyze the value-semantic structure of the individual and to identify the main priorities for the purpose of self-determination and personal growth. • explain purpose, maintenance and tendencies of development of information and communication technologies, to prove the choice of the most acceptable technology for the solution of specific objectives; • explain methods of collecting, storage and information processing, ways of realization of information and communication processes; • describe architecture of computer systems and networks, appointment and functions of the main components; • use information the Internet resources, cloud and mobile services for search, storage, processing and dissemination of information; • apply program and the hardware of computer systems and networks to collecting, transfer, processing and data storage;
Content	Morphology of culture. The concept and essence of culture. Variety of approaches to the definition of the culture essence. The concepts of Space and Time in culture. Anatomy of culture. Forms of culture: myth, art, religion, morality, philosophy, law, politics, science, technology. Language of culture. Culture as a world of signs and meanings. Information and semiotic understanding of culture. Cultural Code. Semiotics of culture. Convention signs. The concept of cultural symbol. Main symbols of culture. Symbols and archetypes of culture. Religion as a sacral form of culture. Main elements of religion. Functions of religion. Culture and government. Conflicting relationships between culture and state. Sociodynamics of culture. Cultural communication. Nomadic culture of Kazakhstan. Medieval culture of Central Asia. The Turkic Renaissance and its place in world culture. XVIII - XIX centuries formation of culture of the Kazakh people. Culture of the Kazakh people in the beginning of the XX century and the 21st century. Cultural policy of Kazakhstan. Cultural Heritage Program. Spiritual revival "The Seven Sides of the Great Steppe"..
Examination forms	The form of the exam is testing in the university system. The exam program defines the evaluation criteria.

	Test form is include single (1 of 5) and multi choice (2 or 3 of 8) options.
Reading list	1. Stoddard E., Collins J. Social and Cultural Foundations in Global Studies. Routledge; 1 edition, 2016. 234 p. 2. Landis K., Macaulay S. Cultural Performance: Ethnographic Approaches to Performance Studies. Red Globe Press; 1st ed. 2017. 272 p. 3. Brazgovskaya E. E. Semiotics. Languages and codes of culture: textbook and workshop for academic bachelor's degree. Moscow: Yurayt Publishing House, 2019. (in Russian) 4. Zholdubaeva A.K. Culturology: Practicum. A.: KazNU named after Al-Farabi, 2019. (in Russian) 5. Gabitov T.H. Culturology: Textbook for university and college students / Comp. T.Gabitov. – Almaty: Lantar Trade LLP, 2020. – 402 p. (in Russian) 6. Jane Stokes. How to Do Media and Cultural Studies , SAGE Publications Ltd, 3rd edition. 2021. 336 p. 7. John Burrows and Kent McNeil. Voicing Identity: Cultural Appropriation and Indigenous Issues. 2022. 336 p. 8. Moltobarova K. I. Culturology. Almaty, – «Almaty-Bolashak» АК, 2022. - 480 p. (in Kazakh)

Discipline designation	**Psychology**
Credit points	2
Semester(s) in which the module is taught	1
Relation to curriculum	OBLIGATORY COMPONENT / Module of social and cultural devolopment
Teaching methods	lecture, seminar, training work, business games, seminar-press conference
Workload (incl. contact hours, self-study hours)	Total workload: 60 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): 20 Private study including examination preparation, specified in hours: 40
Person responsible for the module	***Zholdassova M.****, Senior Lecturer of Department of General and Applied Psychology, PhD,* ***Sadvakassova Z.****, Associated Professor of the Department of General and Applied Psychology, Candidate of pedagogical Sciences (Russian),* ***Rizulla A.****, Senior teacher at the department of social and humanitarian sciences, PhD*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	biology / self-knowledge (at school)
Discipline objectives/intended learning outcomes	The goal is to form ideas about psychological competence, the ability to apply psychological knowledge to analyze professional and life situations.

	To form an understanding of psychological science and practice, the role of psychological knowledge in personal life and professional activity, understanding of mental health and well-being; Understand the nature and causes of psychological phenomena; Identify the general psychological characteristics of one's own personality, situation, group of people; Make effective decisions in communication and activities based on psychological knowledge Apply the skills of self-regulation of the personality, psycho-correction and prevention of psychological health
Content	Psychology as a science. Methodological and methodological aspects of research in psychology. Me and my motivation. General organization of the motivational sphere. Emotions and emotional intelligence. The will of man and the psychology of self-regulation. Creative work or a survey in Google forms in psychology. Individual typological features of the personality. Values, interests, norms as the spiritual basis of personality. Psychology of the meaning of life and professional self-determination. Psychology of personal health. Lifestyle and health. Communication of an individual and groups. The communicative side of communication. The interactive side of communication. The perceptual side of communication. The concept and structure of socio-psychological conflict. Models of personality behavior in conflict. Effective communication techniques
Examination forms	written examination - case study Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Case study - a problematic task in which the trainee is asked to comprehend a real professionally oriented situation necessary to solve a problem. Duration - 2-3 hours
Reading list	1. Nazarbaev N.A. "On the Threshold of the 21st Century". – Astana, 2016. 2. Nazarbaev N.A. "A look into the future". – Astana, 2017. Aronson E. "Köpke ұmtylgan zhalgyz" = The Social Animal: әleumettik psikhologiyaға kirispe: / E. Aronson; room D. D. Duisenbekov. - 11-bass. - Astana: "Ulttyk audarma bureausy" kogamdyk kory, 2018. - 407 p. - (Rukhani zhangyru). 3. Dzhakupov S.M. "Introduction to General Psychology". – A.: Kazakh University, 2014 4. Myers D. "Psychology" / trans. from English. I.A. Karpikov, V.A. Starovoitov. - 4th ed. - Minsk: Potpourri, 2017. - 848 p. 5. Rudenko A.M. "Psychology in diagrams and tables": a textbook. - M: Phoenix, 2016. - 379 p. 6. Antsupov A.Ya., Shipilov A.I. - "Conflictology".- M: Yurayt, 2017.

Instrumental Module

Module Objectives. Students will be able to:

1. use Internet information resources, cloud and mobile services for search, storage, processing and dissemination of information;
2. use software and hardware of computer systems and networks for data collection, transmission, processing and storage;
3. analyze and justify the choice of methods and means of information protection;
4. develop data analysis and management tools using digital technologies for different activities;
5. communicate on a variety of general and educational and professional topics;
6. read, translate and understand authentic texts of a foreign language into the native language using dictionaries and reference books;
7. write official and unofficial letters, fill in forms; write essays and reports arguing points of view;
8. systematize, summarize and describe scientific information

Discipline designation	Foreign Language
Credit points	10
Semester(s) in which the discipline is taught	1, 2
Relation to curriculum	OBLIGATORY COMPONENT / *Instrumental Module*
Teaching methods	Practical lessons (individual, group, project work, discussion, test)
Workload (incl. contact hours, self-study hours)	*15 weeks,* *3 hour per week for Seminar, total 45 Contact hours.* *105 self-study hours*
Person responsible for the discipline	Suttibayev Nurbakhyt Abitayulu Baimuratova Irash Amanovna Mombekova Nurbakhut Bodaukhanovna
Language	*English*
Required and recommended prerequisites for joining the discipline	Foreign language in the scope of the Secondary School Program
Discipline objectives/intended learning outcomes	1. Listening: - understand the main points of the sounding educational text or statement based on knowledge and understanding of the lexical, grammatical and pragmatic systems of the language; - build meanings into a single content of the text / statement in relation to its functional orientation. 2. Speaking: - discuss the content of the educational text, reasonably express their own points of view; - communicate on a variety of general and educational l topics - speak quickly and spontaneously without much difficulty on every day and professional topics; - correctly use the lexical, grammatical and pragmatic types of knowledge in the generation of one's own speech. 3. Reading and writing:

	- interpret the main content of the educational text based on a deep understanding of its key meanings in written and oral speech; - develop models (structural, structural-semantic, pragmatic, cognitive) for understanding and presenting the content of the educational text; - use different types of texts (descriptions, narratives, reasoning) to solve the set educational tasks
Content	Presenting complaints: asking about personal details; asking questions about the presenting complaint; describing and asking about pain; writing up a case report. Working in general practice: Past Simple and Present Perfect. asking questions in the family history; using non-technical language; asking questions in the general history; writing a referral letter. Instructions and procedures: following procedures in training; giving and receiving instructions; making polite requests to patients and colleagues; understanding abbreviations; understanding case notes. Explaining and reassuring: understanding and using non-technical language; explaining complications and reassuring the patient; acknowledging a visual cue; writing information about complications. Dealing with medication: talking about medications; understanding drug charts and abbreviations; explaining benefits and side effects; understandingand using patient language; completing a clinical incident report. Lifestyle: asking about family history and social history; understanding lifestyle changes from the patient's perspective; encouraging and motivating patients; talking with patients about their lifestyles. Parents and young children: understanding and using non-technical language; using the First Conditional for real future events; using the Second Conditional for reassuranceand reflection; reassuring parents; reflecting in speaking and writing about one's experience. Working in psychiatry: describing and assessing psychiatric conditions; using the Past Perfect and using weak forms in speech; asking about self-harm; writing descriptions of a patient's mental state
Examination forms	Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	1. Sam McCarter, Oxford English for careers. Medicine 1, Student's book. Oxford University Press, 2015 2. Raymond Murphy English Grammar in Use. A self-study reference and practice book for Intermediate learners of English. 5th edition. Cambridge University Press, 2020 3. Glendinning Eric H., Howard Ron. Professional English in Use. Medicine. Cambridge University Press, 2018 4. Christina Latham-Koenig, Clive Oxenden, Jerry Lambert English File 4th edition Student's e-Book 2019 Oxford. 5. Eric H. Glendinning, Beverly A.S. Holmstrom 3rd edition English in Medicine. Cambridge Professional English 2010

	6. Chabner, Davi-Ellen Medical terminology: a short course, ISBN: 978-1-4377-3440-9 Sixth edition, 2009

Discipline designation	*Kazakh / Russian language*
Credit points	*10*
Semester(s) in which the discipline is taught	*1, 2*
Relation to curriculum	Obligatory component. Instrumental module
Teaching methods	*Seminar*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *3 hours per week for Seminar, total 45 Contact hours* *105 self-study hours*
Person responsible for the discipline	***Abdrakhmanova Zhazira Asembekkyzy**, Senior Lecturer of the Department of A.Baitursynov Kazakh Linguistics, Candidate of Philological Sciences*
Language	*Kazakh / Russian*
Required and recommended prerequisites for joining the discipline	Kazakh / Russian language in the scope of the Secondary School Program
Discipline objectives/intended learning outcomes	This module of the general education discipline "Kazakh / Russian language" is intended for the development of the learner's language identity, capable of performing cognitive and communicative activities in the Kazakh / Russian language in the areas of interpersonal, social, professional, intercultural communication in the context of the implementation of state programs of trilingualism and spiritual modernization of national consciousness.
Content	The state language is the foundation of the nation. The demand of the society is a qualified specialist. KazNU – the center of Kazakh science and education. Kazakhstan is an independent state. Capital of the Republic of Kazakhstan. Architecture of Kazakhstan. Kazakh cinema art. Baikonur Cosmodrome. The key to knowledge is in the book. Scientific library. Tourism in Kazakhstan. Nature of Kazakhstan. Historical sites of the Kazakh country. Historical monuments in the Kazakh steppe. Historical figures
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Ramazanova Sh. Kazakh language. - Almaty, 2019 2. Salkynbay A. Egizbayeva N. Imankulova S. Rysbay B. Kazakh language. - Almaty, 2016 3. Kuzekova Z.S. The practice of Kazakh language. - Astana, 2010 4. Imankulova S., Egizbayeva N., Imanalieva G., Omarova B., Ramazanova Sh., Mukadieva K. Kazakh language. Manual. - Almaty, 2008.

Elective Component

Module Objectives. Students will be able to:

1. identify barriers in the education of children with special needs;
2. operate with legal concepts and categories related to the legal regulation of anti-corruption activities.
3. assess corruption-related situations for the formation of standards of conduct in accordance with legal, moral and ethical norms.
4. analyze the conditions for maintaining ecological balance and ensuring environmental safety of the environment;
5. predict emergencies and their consequences, make a decision on the choice of the main methods, means and methods of individual and collective protection in emergency situations;
6. explain the factors affecting business activity; distinguish the main activities in the innovative business environment;
7. substantiate the role of the ethical teaching of al-Farabi in the formation of the spiritual and moral foundations of Kazakhstan society;
8. demonstrate the skills of understanding the realities of the modern socio-cultural situation from the standpoint of comparative methodology.

Discipline designation	***al-Farabi and modernity***
Credit points	*5*
Semester(s) in which the discipline is taught	*2*
Relation to curriculum	ELECTIVE
Teaching methods	Lecture, seminar, practice, project
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the discipline	Mussaly Laila, Candidate of Phil. science, Ass. Professor
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	*Prerequisites:* no *Post requisites:* Philosophy, Module of socio-political knowledge, History of Kazakhstan
Discipline objectives/ intended learning outcomes	***Knowledge base***: the purpose of the discipline systematized and holistic presentation of the philosophical heritage of al-Farabi and demonstration of the relevance of his ideas in modern culture. In the process of studying the course, the features of the philosophy of al-Farabi and its significance for modernity are considered, the question of the essence of the scientific and innovative project "Al Farabi university smart city" and its role in the formation of a smart society in Kazakhstan is raised. ***Analysis***: to explain the modern significance of the scientific and philosophical heritage of al-Farabi; ***Synthesis:*** to argue and demonstrate the conviction in the correctness of one's position, the ability to defend it, to take new

	approaches and decisions, based on the fundamental provisions of the philosophy of al-Farabi; ***Evaluation:*** evaluate the impact of Farabi on European science; to show the nature of the influence of al-Farabi's ideas on the modernization of the public consciousness of modern Kazakhstan society; to substantiate the role of the ethical teaching of al-Farabi in the formation of the spiritual and moral foundations of Kazakhstan society; ***Application:*** be able to apply theoretical knowledge in practice and be able to introduce them into the public space, be responsible for quality work, a disciplined and mobile student.
Content	Al-Farabi as a Phenomenon of Philosophy and Cultural Symbol of Kazakhstan. The emergence of the philosophy of al-Farabi. Philosophy of al-Farabi: its subject and purpose. Al-Farabi ontology. Epistemology of al-Farabi. Doctrine of the Mind. Logic. Al-Farabi's Dialogue Strategy. Science of al-Farabi and modernity. Al-Farabi natural science methodology. Civic Science Al-Farabi. The social ideal of al-Farabi in the socio-humanitarian dimension of East and West. Ethical views of al-Farabi. Philosophy of art. The legacy of al-Farabi and the development of Islamic and Western European philosophy. Modern Farabi studies and the study of the heritage of al-Farabi in Kazakhstan
Examination forms	Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	1. Scientific heritage of al-Farabi (comments on the works). - / Ch. ed. G.M. Mutanov; ed. coll. G.K. Kurmangalieva, N.L. Seitakhmetova A.Kh. Bizhanov and others - Almaty: Kazakh University, 2020. - 274 p. (Russian) 2. The era of al-Farabi and the dialogue of civilizations (views on life and philosophical heritage) / Ch. ed. G.M. Mutanov; ed. Colleagues: A. Kasymzhanov, B. Gafurov, A. Derbisali, Zh. Altaev, G. Mukanova, Zh. Imanbaeva. - Almaty: Ch. ed. G.M. Mutanov; ed. Colleagues: A. Kasymzhanov, B. Gafurov, A. Derbisali, Zh. Altaev, G. Mukanova, Zh. Imanbaeva. - Almaty: "Kazakh University", 2020. - 368 p. (Russian) 3. Al-Farabi and modernity: a textbook. - Almaty: Kazakh University, 2014. - 223 p. (Russian, Kazakh, English) 4. Kasymzhanov A.Kh. Al-Farabi (1985) / ed. J.A. Altayeva; KazNU im. al-Farabi. - 2nd study. - Almaty, 2019. - 201 p. (Russian)

Module designation	**Abai's Teaching**
Credit points	5
Semester(s) in which the module is taught	1
Relation to curriculum	ELECTIVE /
Teaching methods	lecture, seminar

Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the module	Mussaly Laila, Candidate of Phil. science, Ass. Professor
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	History of Kazakhstan
Discipline objectives/intended learning outcomes	- to explain the modern significance of the scientific and philosophical heritage of Abai; - to show the nature of the influence of Abai's ideas on the modernization of the public consciousness of modern Kazakhstan society; - to substantiate the role of the ethical teaching of Abai in the formation of the spiritual and moral foundations of Kazakhstan society; - conduct a socio-philosophical analysis of the phenomena of national culture; - demonstrate the skills of understanding the realities of the modern socio-cultural situation from the standpoint of comparative methodology.
Content	Discipline "Abai's studies": goals, objectives, expected results of the discipline. The doctrine, the concept of Abai's teaching. The essence and essence of Abai's teaching. The essence of man and space and time in the teachings of Abai. The concept of knowledge and education in the teaching of Abai and his system. Prerequisites and sources of Abai's teaching. Abai's teaching and the traditional worldview and culture of the Kazakh people. Abai's teaching and traditions of the peoples of the East, worldview and culture. Abai's teaching and traditions of the peoples of the East, worldview and culture. Abai's teachings and its components. The importance and significance of reason in the teaching of Abai. The importance and significance of reason in the teaching of Abai Categories willpower. The meaning of the heart in the teachings of Abai. Five noble deeds in the teaching of Abai. Five bad things in Abai's teaching. A tool for measuring all the good in Abai's teaching.
Examination forms	Written examination: Test Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.

Reading list	1. Abaytanu. Tandamaly enbekter. 1-50-tomdar / Zhalpi editoriyasyn baskargan Zh. Dadebayev. - Almaty: Kazakh University, 2020-2021. 2. Abaytanu anthologiyasy. He is tomdyk. I-X tomdar / Bass editors J. Tuimebayev. Zhalpa editoriyasyn baskargan Zh. Dadebaev. - Almaty: Kazakh University, 2021. 3. Dadebaev Zh. Abaydyn anthropologizmi. - Almaty: Kazakh University, 2018– - 238 b. 4. Kunanbayev A. Tandamaly shygarmalary. Eki tomdyk. I, II tomdar / Zhalpy ed. bask. Zh. Dadebaev. - Almaty: Kazakh University, 2021. 5. Abai (Ibrahim) Kunanbayuly. Tandamaly danalyk sozder / Kurastyrgan, zhalpi editoryasyn baskargan Zh. Dadebaev. - Almaty: Kazakh University, 2019. - 96 b.

Discipline designation	**Legal bases of corruption control**
Credit points	5
Semester(s) in which the module is taught	2
Relation to curriculum	ELECTIVE /
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the discipline	***Umarov Ilhom Mirsabitovich****,* *Senior Lecturer of Department of Business Technology*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	
Discipline objectives/intended learning outcomes	- to substantiate and explain the anti-corruption policy of the Republic of Kazakhstan; - to determine the forms and methods of manifestation of corruption in various spheres of life; - to operate with legal concepts and categories related to the legal regulation of anti-corruption activities; - to assess corruption-related situations for the formation of standards of behavior in accordance with legal and moral and ethical norms; - to perform anti-corruption behavior; - to form a legal anti-corruption thinking and consciousness.
Content	Subject and method of economic theory. Ownership. Entrepreneurship. The nature and mechanism of functioning of market economy. Fundamentals of the theory of production and costs. The distribution of income. Income and the prices of factors of production. National economic system and its equilibrium. Economic growth. Macroeconomic instability. Unemployment. Inflation. The financial mechanism of economic regulation.

	Foreign economic activity of the state. The concept and essence of corruption. Standards of anti-corruption behavior.
Examination forms	Short Answer & Fill-in-the Blank Multiple choice Test in the “Univer” platform
Reading list	1. Robert Rotberg. Anticorruption, 2020 2. Privatization in the Republic of Kazakhstan: collection of the normative. the legal acts. - Almaty: Lawyer, 2019. 3. Borisov E. F. Economic theory: Textbook. – M., 2018 4. Borisov E.F. Economic Fundamentals. Workshop. Tasks, Tests, situations: manual. – M.: Higher school, 2017. 5. Gamarnik G. N. Management of economy of Kazakhstan: methodology, approaches, ways of realization. – Almaty: Economy, 2021.

Discipline designation	**Ecology and Human Life Safety**
Credit points	5
Semester(s) in which the module is taught	2
Relation to curriculum	ELECTIVE
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*
Person responsible for the discipline	school curriculum
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	
Discipline objectives/intended learning outcomes	- to justify the dangerous and harmful factors of the human environment; - to analyze the conditions for maintaining ecological balance and ensuring environmental safety of the environment; -to assess ways to reduce human impact, leading to climate change and the destruction of the ozone layer of the Earth, the preservation of biodiversity and the prevention of desertification and land degradation; - to organize rescue operations in emergency situations of various kinds; - to use legislative and legal frameworks in the field of safety and environmental protection in practice; - to predict emergencies and their consequences, make a decision on the choice of the main methods, means and methods of individual and collective protection in emergency situations.
Content	Introduction. Ecology and the problems of modern civilization. Autecology - ecology of organisms. Demecology - population ecology. Synecology - community ecology. Biosphere and its

	stability. The concept of living matter. The global biogeochemical cycles. The environmental crisis and the problems of modern civilization. Classification of hazards emergency. Emergency peacetime and wartime. Weapons of mass destruction. Ensuring environmental safety. Providing medical and biological safety. Dangerous diseases of the XXI century: drug abuse, sexually transmitted infections, HIV / AIDS, tuberculosis and others. Natural hazards. Earthquakes. Natural hazards. Selle, floods, avalanches and others. Social danger. Religious sects. Terrorism. Actions of the population in the capture of terrorists.
Examination forms	Multiple choice Test in the "Univer" platform 300 questions base. 40 questions in 90 minutes. Available options: 1 correct of 5, and 2 or 3 correct of 8.
Reading list	1. Hwang, T. A. Ecological foundations of nature management: a textbook for SPO [Electronic resource] / T. A. Khvan. - Electron. Dan. - 6th ed., revised and additional - Moscow: Yurayt Publishing House, 2019. - 253 p. - Mode access: https://biblio-online.ru/bcode/433289 - Head. from the screen. 2. Astafieva, O.E. Ecological bases of nature management: textbook for free software [Electronic resource] / O.E. Astafieva, A.A. Avramenko, A.V. Pitryuk. - Electron. Dan. - Moscow: Yurayt Publishing House, 2019. - 354 p. - Access mode: https://biblio-online.ru/bcode/442489 - Head. from the screen. 3. Vashchalova, T.V. Ecological bases of nature management. Sustainable development: a textbook for secondary vocational education Electronic resource] / TV Vashchalova. - 3rd ed., Rev. and add. - Moscow: Yurayt Publishing House, 2020. - 186 p. - Access mode: https://biblio-online.ru/bcode/448709 - Head. from the screen. 4. Kuznetsov, L. M. Ecological foundations of nature management: textbook for secondary vocational education [Electronic resource] / L. M. Kuznetsov, A. Yu. Shmykov; edited by V. E. Kurochkin. - Moscow: Yurait Publishing House, 2019. - 304 p. - Access mode: https://biblioonline.ru/bcode/441220 - Head. from the screen 5. https://elib.kaznu.kz/

Discipline designation	**Entrepreneurship**
Credit points	5
Semester(s) in which the module is taught	1
Relation to curriculum	ELECTIVE
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*

Person responsible for the discipline	***Yerdavletova Farida Kazizovna**, Acting professor, Candidate of Economics Science*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	
Discipline objectives/intended learning outcomes	- describe the main types of innovation and projects, the best ways and methods of project evaluation; list the properties of innovative entrepreneurship; - explain the factors affecting business activity; distinguish the main activities in the innovative business environment; - analyze the degree of effectiveness of innovation projects; to make decisions in the selection of the optimal and effective project; to forecast the development of an innovative project; - to assess the level of influence of economic and social factors on the TE indicators of the innovation project; - to compare and draw conclusions on innovative projects by sectors of the economy.
Content	Key Frameworks and Models. Accounting Basics (Mandatory). From Idea to Opportunity. Creativity and Innovation. Legal Matters + Venture Lab #1. Global Marketing & Sales. The Lean Startup. Venture Finance I (Sources). Venture Finance II (Staged Financings). "Special Topics in Entrepreneurship" Midterm Debates. Team Dynamics + Venture Lab #2. Founder's Dilemma I (Equity Splits). Founders Dilemma II (CEO Succession). Venture Finance III (Stock Options). Personal Business Plans
Examination forms	Case-study / scenario question Computational
Reading list	1. Akazi Kanoze Youth Livelihood project (2019), Work Readiness Trainer Manual. Education Development Centre (EDC), Work Force Development Authority (WDA), Kigali Akazi Kanoze Youth Livelihood project (2018), Small Business and Coperative, Education Development Centre (EDC), USAID. 2. National Curriculum Development Centre (2021), Entrepreneurship for Secondary Schools Book 1 3. Kanyike John Paul (2019), Entrepreneurship Education Book 1, 2&3

Discipline designation	**Scientific research methods**
Credit points	5
Semester(s) in which the module is taught	1
Relation to curriculum	ELECTIVE
Teaching methods	lecture, seminar
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *105 self-study hours*

Person responsible for the discipline	***Taipakova Sabira Myktybekkyzy,*** *Senior Lecturer of the Department of Molecular Biology and Genetics, PhD*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	
Discipline objectives/intended learning outcomes	- Assess achievements of fundamental sciences on which modern genetics is based in accordance with the specialty and specialization. - Use advanced technologies in professional activities and systematize the results of scientific research by processing literary data. - Explain the principle of modern methods of genetics. - Improve qualifications in the professional field of genetics; in scientific work by the specialty - Summarize the information obtained from literary sources on genetics and related sciences. - be able to find and make decisions among different opinions
Content	K
Examination forms	Case-study / scenario question Computational
Reading list	1. Akazi Kanoze Youth Livelihood project (2019), Work Readiness Trainer Manual. Education Development Centre (EDC), Work Force Development Authority (WDA), Kigali Akazi Kanoze Youth Livelihood project (2018), Small Business and Coperative, Education Development Centre (EDC), USAID. 2. National Curriculum Development Centre (2021), Entrepreneurship for Secondary Schools Book 1 3. Kanyike John Paul (2019), Entrepreneurship Education Book 1, 2&3

CORE DISCIPLINES
University component

M-4 Aspects of natural sciences

Module Objectives. Students will be able to:

- systematize the latest achievements in the field of botany, zoology, chemistry, mathematics and explain the changes in substances encountered during chemical, mathematical processes;
- to use knowledge and methods of plant and animal morphology in solving theoretical, practical problems and performing scientific research;
- using mathematical and chemical methods to explain biological processes;
- application of mathematical and chemical laws in the systematization of the laws of biodiversity formation;
- application of methods of systematization of plant and animal taxonomy in botanical and zoological research;
- analysis of the relationship between the theoretical and practical significance of plants and invertebrates of the lowest level with other natural sciences;
- analysis of species variability in determining the diversity of the species composition of ecobiotopes, the main methods of studying plant and invertebrate animals of the lowest stage;
- to identify the causal relationship between the features in the field of botany, zoology, chemistry, mathematics;

Discipline designation	Zoology of invertebrates and lower plants
Credit points	9
Semester(s) in which the module is taught	1
Relation to curriculum	*University component.* *Plant anatomy and morphology* *Cell Biology and histology* *Human and animal physiology* *Microscopic technique and human and animal anatomy*
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	15 weeks, *1 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Lab, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	**Omarova Zhanar** *Senior lecturer of the Department of biodiversity and Bioresources, Candidate of Biological Sciences* **Nurmahanova Akmaral Sadykovna** *Ass.proffessor of the Department of biodiversity and Bioresources PhD*
Language	*Kazakh, Russian, English*

Required and recommended prerequisites for joining the module	To study this module, students must master the school curriculum in botany
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form for students the classification, structure, ways of reproduction, biological and environmental features of lower plants and invertebrates. **Learning outcomes:** – Determination of classification, adaptation to the environment, changes in the structure of invertebrate animals and lower plants. – Mastering methods for collecting and identifying invertebrate animals and lower plants in Steppe conditions; – Master the ways of reproduction of invertebrates and lower plants.
Content	The simplest insect is Protozoa. Explanation of the systematics and general characteristics of insects at the cellular level. Three-layer animals. Parenchymal and primary cougar worms. The type of flatworms is Plathelminthes. Roundworm type. Life cycle of the main representatives. The arthropod type is Arthropoda. Systematics of arthropods, general characteristics. A branch of the gill-breathing type. Class of crustaceans. Tracheal breathers type branch. Mollusca type-Mollusca. Classification. Characteristics and significance of the type. Classification. The main features of construction. Introduction to the importance of plants in the biosphere and human life. Taxa comment on binary name terms. Study of the features of highly specialized forms of red algae, determining the alternation of their progenitor and nuclear phases. With the peculiarities of highly specialized forms of red algae, the alternation of their generation and nuclear phases. Classification, structure, features, ways of reproduction of algae conjugates, or conjugatophyta (Sonjugatophyta), Hara (Sharophyta). Class of chytridiomycetes (Chytridiomycetes), Class of Hyphochithromycetes (Hyphochytriomycetes) classification of the Class of oomycetes (Oomycetes), structure, features, ways of reproduction, importance in the economy. Class Zygomycetes (Zygomycetes), class Ascomycetes (Ascomycetes), class Basidiomycetes (Basidiomycetes), Class of immature fungi (Deuteromycetes) classification, structure, features, ways of reproduction, importance in the economy. Examination of the structure of representatives of the class of Zygomycetes (Zygomycetes), Class of Ascomycetes (Ascomycetes), Class of Basidiomycetes (Basidiomycetes), Class of immature fungi (Deuteromycetes), determination of the formation of Mucor mucedo from bread, vegetables
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1.Dautbaeva K. A. Zoology of invertebrates. Book 1-2: textbook. - Almaty: 2004 – Pp. 376 2.Dautbaeva K. A., Shalgymbaeva S. M. Zoology. Part I. Invertebrate zoology. Almaty, 2013.Pp.186

	3. Satybaldieva G. K., Ormanova G. zh., Baimurzaev N. B. Zoology of invertebrates (workshop): manual/ - Almaty: Kazakh University, 2014. – P. 148 4.Ametov A. A. Botany. Book. Almaty: 2015. -Pp512 5. Nazarbekova S. T., Nurmakhanova A. S.,Childibaeva A. zh., Tynybekov B. M. Textbook of Algology. - Almaty.: Kazakh university, 2015. - Pp. 206 . 6. Begenov A. B., Ametov A. A., Eszhanov B. E., Abidkulova K. T., Nurmakhanova A. S., Satybaldieva G. K., Tynybekov B. M., Baimurzaev N. B., Childibaeva A. Methodological guidelines for conducting educational practice in Botany. Training manual. Almaty.; Kazakh university, 2015. – Pp. 81 7. Nurmakhanova A. S., Nazarbekova S. T., Childibaeva A. zh., Tynybekov B. M. Hydrobotany textbook. - Almaty.: Kazakh University, 2020 - Pp. 226

Discipline designation	Chemistry and Mathematics
Credit points	*6*
Semester(s) in which the discipline is taught	*2*
Relation to curriculum	University component *Biochemistry, Biostatistics*
Teaching methods	*Lecture, Seminar*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *4 hours per week for Seminar, total 30 Contact hours.* *120 self-study hours*
Person responsible for the discipline	**Nazarkulova Sh.N.** Senior lecturer of Department of General and Inorganic Chemistry, PhD **Nilupar Atakhan** *Senior Lecturer of the Department of Mathematics, PhD;*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	school courses in physics and mathematics, further mathematics (vector algebra, integrals of all kinds, differential, total and partial derivatives, divergence operators, rotor)

Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability for practical application of elements of higher mathematics and physics in applied problems of biology and genetics. **Learning outcomes** During the course of the course, to form students' abilities: – be able to explain the most important experimental facts proving the correctness of chemical theories; – be able to apply the basic stoichiometric laws of chemistry to solve problems of general and inorganic chemistry; – to show the relationship between the composition, structure and properties of inorganic substances; – to reveal and show the genetic relationship between the main classes of inorganic substances; – replacement of isolated private research with the most system-wide methods; – ability to see the final solution of specific tasks; – to understand the power, universality, integrity and correctness of mathematical methods that find their accuracy in practice; – development of logical thinking among students; – mastering the skills of independent thinking and general mathematical culture; – the ability to work in a team, to prove the correctness of your method in choosing a solution to a problem.
Content	Basic theorems and methods of linear and vector algebra, elements of discrete mathematics, analytical geometry. Basic methods for differentiating and integrating functions, functions of a complex variable, elements of probability theory. Mathematical models in biology and genetics. Fundamentals of chemistry for solving problems of general and inorganic chemistry.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. The Association For Science Ed, Teaching Secondary Physics, Third Edition, Hodder Education (May 28, 2021) 2. Tom Denton and Andrew Waldron. Linear Algebra in Twenty Five Lectures - 2012 3. Rod Haggarty, Fundamentals of Mathematical Analysis, Oxford Brrokes University, 2000 4. Abildayev A. Physics: textbook.- Almaty: Qazaq University, 2020. - 336 p. 5. Mathematical analysis-1: methodological guide. - Almaty: Qazaq University, 2020. - 99 p. 6. Satygulova S., Iskakova A.K., Aitzhanov S.E. Mathematical analysis I: textbook. - Almaty: Qazaq University, 2020. - 236 p. 7. Kunakov S.K. Physics for University Students. Course of Modern Physics: textbook. - Almaty : Qazaq University, 2020. - 97 p.

M-5 Plant structure

Module Objectives. Students will be able to:

- systematize and present the latest data in the field of plant anatomy and morphology and prospects for their use in various fields of biology and medicine;
- to use microscopic knowledge in solving theoretical, practical problems and performing scientific research;
- to show methods of morpho-anatomical studies in experimental biology to explain the most important botanical processes;
- to show and describe the features of the interaction of plants with the surrounding nature, to identify age and seasonal changes in plants;
- analysis of practical significance in connection with natural sciences;
- formation of modern methods of solving scientific problems in the field of studying the structure of plants;
- analysis of the relationship between the determining environmental factor and the structure of the plant;
- application of knowledge about the structure of plants in biology, pharmacy and other fields of natural sciences;

Discipline designation	Biochemistry
Credit points	6
Semester(s) in which the discipline is taught	3
Relation to curriculum	University component *Chemistry and Mathematics*
Teaching methods	*Lecture, Seminar, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *1 hours per week for Seminar, total 15 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact hours.* *120 self-study hours*
Person responsible for the discipline	***Goncharova Alla Vladimirovna*** *Associate Professor of the Biotechnology Department, Candidate of Biological Sciences*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	*Chemistry and Mathematics*
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form students' ability to acquire knowledge about the structure, properties, functions of the most important biological compounds, as well as about the molecular mechanisms of the main metabolic processes occurring in living organisms and use this knowledge to solve professional problems. **Learning outcomes:** - demonstrate knowledge about the features of molecular organization and metabolism of the most important biological compounds of living organisms;

	- to choose adequate modern biochemical methods of extraction and research of biological material; - plan and conduct a qualitative and quantitative analysis of biological material; - interpret the results of biochemical experiments, evaluating the relationship between the structure of biomolecules and their functions at the molecular level; - predict the possibility of using the most important biological molecules and biochemical processes to solve professional problems.
Content	Proteins. Structure, classification, functions. Levels of structural organization of protein molecules. Structural features of various proteins and areas of their application. Enzymes. Structure, properties, mechanism of action of enzymes. The mechanism of action of enzymes. Kinetics of enzymatic catalysis. Classification of enzymes. The role of enzymes in metabolism. Carbohydrates. Functions, structure, classification. Distribution of carbohydrates in nature. Importance of carbohydrates for living organisms. Lipids. Functions, classification, main structural components. Saponifiable lipids. unsaponifiable lipids. Structure, main representatives. distribution in nature. Biomedical significance of lipids. Steroids. blood lipoproteins.Structure and functions of nucleic acids. Levels of organization of nucleic acids. Types of RNA, their characteristics.Protein biosynthesis. The main stages of translation. Features of translation in eukaryotes and prokaryotes. Comparative aspect.Hormones. Classification, structure. main representatives. The use of hormones in medicine. Mechanisms of action of hormones.Fundamentals of metabolism. Metabolism of carbohydrates. (glycolysis, gluconeogenesis). Tricarboxylic acid cycle. Bioenergetics of the cell. Electron transport chain.Protein catabolism. The main pathways for the breakdown of amino acids in the body. Ways to neutralize ammonia in the cell. Ornithine cycle.Lipid metabolism. Oxidation of fatty acids. Synthesis of fats in the cell.
Examination forms	Oral standard exam, or testing in Moodle. Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes Test in the “Moodle” platform: 75-100 questions base; the test form includes 4 types of questions that must be used in equal proportions in 1 test set (for example, 6 multiple choices + 6 true/false + 6 short text + 7 for compliance = 25); exam - 60 minutes for 25 questions.
Reading list	1. Ed. Severina E.S. Biochemistry. GEOTAR-Media, 2020. 2. Ed. Danilova L.A. Biochemistry. Spetslit, St. Petersburg, 2020. 3. Ed. Severina E.S. Biochemistry with exercises and tasks. GEOTAR-Media, 2016. 4. Ya.Kolman, K.G-Rem Visual biochemistry. Knowledge Lab, 2021 (translated from English by Masolova)

	5. G. G. Borisova, N. V. Chukina, I. S. Kiseleva, M. G. Maleva Biochemistry. Workshop. Yekaterinburg: Publishing House Ural. un-ta, 2017. - 116 p. (electronic version) 6. Wilson K., Walker D. Principles and methods of biochemistry and molecular biology, Binom, 2015.

Discipline designation	Plant anatomy and morphology
Credit points	9
Semester(s) in which the module is taught	4
Relation to curriculum	University component Zoology of invertebrates and lower plants Microscopic technique and human and animal anatomy
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	***Akhtayeva Nursulu Ziyakhanovna**, Associate Professor of the Department of Biodiversity and Bioresources,* *Candidate of Biological Sciences*
Language	Kazakh, Russian
Required and recommended prerequisites for joining the module	To study this module, students must master the school curriculum in botany
Discipline objectives/intended learning outcomes	**Discipline objectives**: To form students' knowledge about the structural features of the plant cell and plant tissues, the morphology and anatomy of the shoot, root and generative systems, to know the main directions of the morphological evolution of plants, the biological essence of reproduction and reproduction, age and seasonal changes in plants. **Learning outcomes:** – Determination of the features of the structure of plant cells and plant tissues. – Distinguish between vegetative and genarative organs of plants. – Analysis of the main directions of morphological evolution of plants. – Determination of the biological essence of reproduction and reproduction. – Distinguish between young and seasonal changes in plants.
Content	Formation of morphology as a science. Evolution of the body shape of plants, general patterns of the structure of vegetative organs. Vegetative organs of higher plants. Root morphology.Vegetative organs of higher plants. Morphology of the shoot and stem. Vegetative organs of higher plants. leaf morphology. Generative organs of higher plants. Flower. Generative organs of higher plants. Morphology of inflorescences.Reproduction of plants.Fruit and seed.Introduction to the definition of plants. Anatomy of plants. Subject and methods of plant anatomy. The formation of plant anatomy as a science. Features of the organization of a plant cell.

	Classification of plant tissues. Educational fabrics. Tissues derived from apical and lateral meristems. Anatomical organization of the stem of herbaceous plants. Anatomical organization of the stem of woody plants. Anatomical organization of the leaf. Anatomical organization of the root. Transition zone from shoot to root
Examinationforms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Readinglist	1. Aidosova S.S., Akhmetova A.B. Laboratory workshop on "Structural botany". Almaty: Publishing House "Kazakh University", 2010 2. Botany: in 4 volumes: textbook. for university students / ed. A. K. Timonina.- M .: Academy, 2009. Vol. 4, book. 2: Systematics of higher plants. 3. Abdrakhmanov O., Abdrakhmanova A.O., Nazarbekova S.T., Nurkenova A.T., Gavrilkova E.A. Systematics of lower plants.. - Karaganda. 2009. 4. Lotova L.I. Botany: morphology and anatomy of plants. M., Komkniga publishing house, 2007 7. Botany. Course of algology and mycology. - M., 2007 5. Gulenkova M.A., Viktorov V.P. Plant anatomy. Part 1. Cell. Fabrics: Textbook / Gulenkova M.A., Viktorov V.P. - M.: MPGU, 2015. - 120 p. ISBN 978-5-4263-0239-6// http://znanium.com/catalog.php?bookinfo=754429 6. Starostenkova M.M. Field practice in botany [Electronic resource]: textbook. manual for universities / Starostenkova M. M. and others - 2nd ed., revised. and additional - M. : GEOTAR-Media, 2014.-240p.- http://www.studmedlib.ru/book/ISBN9785970431160.html 7. Workshop on botany [Electronic resource]: textbook. allowance / Novosib. state agrarian un-t. Agronomist. factor; comp. S. Kh. Vyshegurov, E. V. Palchikova. - Novosibirsk: NSAU, 2013. - 180 s // http://znanium.com/bookread2.php?book=515928

M-6 Morphology of humans and animals

Module Objectives. Students will be able to:

- systematize and present the latest data in the field of human and animal morphology and the prospects for their use in various fields of biology and medicine;
- to use methods and knowledge of human and animal morphology in solving theoretical, practical issues and performing research work;
- demonstrate morphological research methods in experimental biology to explain the most important biological processes;
- to systematize the structure of humans and animals, based on the microscopic and macroscopic structure of organs and tissues, taking into account the individual development of organisms.
- demonstrate methods of microscopic technique in the study of human and animal morphology;
- analyze the theoretical and practical significance of human and animal morphology in relation to other natural sciences;
- to use the knowledge of human and animal morphology in fundamental biology, bioindication, medicine and other areas of the natural sciences;
- to systematize knowledge in the field of individual human development from the beginning of gametogenesis, fertilization, embryonic and postembryonic human development to aging and death;

Module designation	Cell Biology and histology
Credit points	9
Semester(s) in which the module is taught	4
Relation to curriculum	University component *Microscopic technique and human and animal anatomy* *Vertebrate Zoology and higher plants*
Teaching methods	*Lecture, Seminar, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 60 Contact* *180 self-study hours*
Person responsible for the module	**Shalakhmetova Tamara Minajevna** *Professor of Department* Biodiversity and Bioresources, *Doctor of Biological Science*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plants
Module objectives/intended learning outcomes	**Discipline objectives**: To form an idea of the history of Cytology, the relationship of this science with other biological sciences, cytological terminology, the main provisions of cell theory,

	methodological approaches to the analysis of the structure and function of cells and cell organelles in normal and pathological conditions. **Learning outcomes:** – Application of structural and functional organization of cells to solve complex research problems in the field of cell biology – Classification of technologies for collecting, analyzing, generalizing and interpreting scientific information. – Search, critical reading and evaluation of the level of evidence of scientific publications in the field of regulation of bioprocesses.
Content	The history of the development of cytology and the structure and functioning of cells. Postulated cellular theory.General laws of organism adaptation. The organization of biomembrane, chemical composition hyaloplasm, cytosol. Model structure membrane. Biomembrane function (barrier-transport, receptor, intercellular connections). Single-membrane organelle cells: cytoplasmic network Types and levels of adaptation, its genetic limits. Double-membrane organelle cells: mitochondria and plastids. Non-membrane organelle cells: ribosome, cytoskeleton, cell center. Structure and function of the cell nucleus. Structure and function of chromatin: eu- and heterochromatin. Chromosomal cycle. Structure and function of the nucleus. Granular and fibrillar components of the nucleus. Cell cycle. Regulation of the cell cycle. Mitosis stimulation factor. Cell division (mitosis and meiosis). Meiosis. Spore and gametic type of meiosis. Stages of meiotic division. Crossingover. Cell differentiation. Pleuro- and totipotny cells. Differential activity of genes. Morphogenesis. Dedifferentiation. Cell pathology. Cell death. Necrosis and apoptosis
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1.Chentsov Yu.S. Introduction to cell biology. Textbook. M., Moscow State University, 2014. 494 p. 2. Zavarzin A.A., Kharazova A.D., Molitvin M.N. Cell biology: general cytology. SPb.: Izd-vo SPb. Un-ta, 1992, 239 p. 4. Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988. 5. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 6. Afanasyev Yu.I. etc. Histology. M., 2000, 678p. Additional: scientific journals: "Cytology", "Ontogeny", "Molecular biology", "Genetics" This literature can be obtained by subscription or in the reading room of the National Library of KazNU named after al-Farabi (see the map of the provision of educational literature) I

Module designation	Microscopic technique and human and animal anatomy
Credit points	9
Semester(s) in which the module is taught	4
Relation to curriculum	University Component *Cell Biology and histology* *Human and animal physiology* Elective component *Private Histology* *Cellular and tissue pathology*
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	**Abdullayeva Bagila Aidarovna** *Senior Lecturer of the Department of Biodiversity and bioresources, Candidate of Biological Sciences* **Zharkova Irina Maratovna** *Senior Lecturer of the Department of Biodiversity and bioresources, Candidate of Biological Sciences*
Language	Kazakh, Russian
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plants, Biochemistry, Cell Biology and histology, General biology, computer science, sociology, bioethics
Module objectives/intended learning outcomes	The purpose of the discipline: to form a holistic view of the origin and structure of the development of the human and animal organism, its systems and organs, including their microscopic and ultramicroscopic structure, as well as the main methods for studying the microscopic structure of cells and tissues; to teach students the basic methods of preparing histological preparations with their subsequent study and description for professional preparation for work in cytological and histological laboratories. In the course of studying the course, to form students' abilities: – have an idea about the regularities of the structural organization of organs and systems of human and animal organs and methods of microscopic technology; – know the structure and functions of organs and systems of human and animal organs, the stages of histological and cytological processing of biological material, general and special methods of staining histological preparations; – be able to determine on models and in atlases the structural components of organs and systems of human organs, prepare cytological and histological preparations of organs and tissues of humans and animals;

	– conduct a comparative analysis of the observed structural changes in organs and tissues of humans and animals based on macroscopic and microscopic research methods; – use knowledge of microscopic technique and anatomy of humans and animals to solve theoretical, practical issues and in the performance of research work.
Content	Organization of a research histological laboratory. The main stages of preparation of histological preparations. Techniques for staining histological preparations (survey, histochemical, immunohistochemical). Modern aspects of the development of microscopic technology. Types of microscopy. The structure of the microscope. Fundamentals of microscopy of preparations. Organization of the anatomical structure of humans and animals. Musculoskeletal system. Digestive system. Urogenital system. Cardiovascular system. Organs of hematopoiesis and immunogenesis. Endocrine system. Nervous system. Sense organs.
Examination forms	Test Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Fundamentals of quality assurance in histological laboratory technology: Guide / Ed. P.G.Malkov, G.A.Franka / P.G.Malkov, G.A.Frank, L.V.Moskvina, N.V.Danilova, L.E.Zavalishina. - M., 2011. - 108 p. 2. Korzhevsky D.E., Gilyarov A.V. Fundamentals of histological technique. St. Petersburg: SpetsLit, 2010. - 95 p. 3. Sapin, M.R.. Human Anatomy.- M., 2020 4. Sinelnikov, R.D. Atlas of human anatomy. - M., 2018 5. Kurepina, M.M.. Human Anatomy.- M., 2017

M-7 Biodiversity of flora and fauna

Module Objectives. Students will be able to:

- to systematize and use the latest achievements in the field of taxonomy of higher plants and vertebrates for application in theory and practice;
- substantiate phylogenetic relationships between organisms;
- establish the degree of relationship between various taxa of higher plants and vertebrates;
- competently state and critically analyze the regularities of the taxonomy of higher plants and vertebrates using the botanical and zoological conceptual apparatus;
- own methods of description and classification of higher plants and vertebrates;
- to recognize the main studied objects (higher plants, vertebrates) in preparations, herbariums, stuffed animals, collections;
- highlight progressive, primitive, as well as features of specialization in the structure of plants and animals;
- determine the cause-and-effect relationship between lifestyle and structural features;

Module designation	Vertebrate Zoology and higher plants
Credit points	9
Semester(s) in which the module is taught	3
Relation to curriculum	University Component *Cell Biology and histology* *Plant anatomy and morphology* *Cell Biology and histology* *Microscopic technique and human and animal anatomy* *Bioresources of Kazakhstan* *Elective component* *Plant ecology and theory of evolution* *Introduction of plants* *Biology and ecology of mammals*
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	**Childibayeva Assel Zhumagulovna** *Senior lecturer of the Department of Biophysics, PhD*
Language	*Kazakh, Russian*
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plants

Module objectives/intended learning outcomes	**Discipline objectives**: classification of diversity, basic patterns of formation, evolution, systematics, economic, medical and commercial significance of vertebrate animals and higher plants, ways of reproduction, explanation of ways to use methods in zoological and botanical research. **Learning outcomes:** – To trace the diversity of vertebrates and higher plants, the basic patterns of formation. – Analysis of Systematics with the evolution of the main representatives of higher plants with vertebrates. – Determining the place and role of animals and plants in ecological systems – Classification of economic, medical and commercial importance – Application of methods in zoological and Botanical Research – Master the collection and preparation of scientific materials on biology, mathematical processing of the results of field and experimental research
Content	Introduction. The subject of Zoology of invertebrates and lower plants goals and objectives. Physiological mechanism of biological rhythm. Biological rhythms and alcohol. Violation of the biological rhythms of alcoholics (diseases). Indicators of the daily chronogram of a healthy person. Synchronization of biological rhythms.Influence of stress factors on the physiological parameters of the human body. Chronophysiological aspects of sports training. Influence of hypoxia, noise, vibration on the dynamics of human and animal biosecurity indicators. Models of synchronization of biological rhythms. Resonance phenomena in a dynamic system. Study of the impact on biofertilizer through healthy lifestyle advertising.Changes arising from the change of time zones in the human biological rhythm.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions

Reading list	1. Ametov A. A. Botany. Almaty: era, 2015-512 P. 2. Satybaldieva G. K., Tynybekov B. M., Baimurzaev N. B., Childibaeva A. zh., Nurmakhanova A. S. methodological guidance on conducting educational practice on Botany. Almaty: Kazakh university, 2020. – 78 P. 3. Nazarbekova S. T., Nurmakhanova A. S., Childibaeva A. Zh., Tynybekov B. M. Algology. Almaty: Kazakh university, 2021. - 206 P. 4. Nurmakhanova A. S.,Childibaeva A. Zh., Tynybekov B. M., Nazarbekova S. T. Hydrobotany. Kazakh University, Almaty, 2020.175 P. 5. Nurmakhanova A. S., Tynybekov B. M., Childibaeva A. zh., Nazarbekova S. T. water and coastal plants. Almaty: Kazakh University 2021. -122 P.

M-8 Biostatic methods of molecular biology

Module Objectives. Students will be able to:

- systematize the theoretical foundations and methodology of molecular biology, features of the molecular structure of nucleic acids and proteins;
- explain the regularities of the distribution of random variables, grouping of a set of data methods for calculating and evaluating sample indicators and analysis of variance;
- analyze the molecular basis of genetic anomalies;
- analyze the classification of forms of genetic hereditary pathology;
- have the skills to use modern methods of studying the structure and physico-chemical properties of nucleic acids and proteins;
- use biostatistical methods in explaining the mechanisms and methods of repair, recombination of genetic material, protein translation, RNA maturation, replication, transcription;
- to use the skills of applying the basic methods of biostatistical analysis to solve problems of molecular biology;
- apply regularities in independent observations and experiments, the ability to analyze, generalize and draw conclusions about the observed phenomena;

Discipline designation	Biostatistics
Credit points	*6*
Semester(s) in which the discipline is taught	*5*
Relation to curriculum	University component *Chemistry and Mathematics*
Teaching methods	*Lecture, Laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *3 hours per week for Laboratory work, total 45 Contact hours.* *120 self-study hours*
Person responsible for the discipline	**Biyasheva Zarema Maratovna** *Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science;* **Chunetova Zhanar Zhumabekovna**

	Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science; **Lovinskaya Anna Vladimirovna** *Senior Lecturer of Department Molecular Biology and Genetics, PhD*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	Chemistry and Mathematics
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to select and use statistical analysis methods to determine the reliability of the results of genetic studies. **Learning outcomes***:* - classify the basic statistical methods and concepts; terms and symbols of biostatistics; - plan a scientific experiment taking into account the determination of the sample level of the study; - analyze and process the results of scientific research and make scientifically based conclusions; - show the possession of statistical analysis, the ability to work with mathematical and statistical tables. - use basic methods of statistical processing of results (Student's test, F-test, chi-square test, correlation analysis, one-factor analysis of variance), including using the software.
Content	Implementation and application of statistical methods in biology. Collection, Organization and Visualization of Data. Describing data. Sampling and sampling distributions. Theoretical distributions. Hypothesis testing. Errors in hypothesis testing. Evaluation of the statistical significance of the research results. Student's test. Analysis of qualitative features. Contingency table chi-square ($\chi 2$) test. Correlation analysis. F-test, ANOVA, Fisher test. Non-parametric tests. Additional methods: Diagnostic tools, Systematic reviews and meta-analysis and others. Study design.
Examination forms	Written standard exam or Test Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	1. Biyasheva Z.M., Lovinskaya A.V. Introduction to Biostatistics (biometry): educational manual, Almaty: Qazaq university, 2017 – 182p. 2. Rosner B. Fundamentals of Biostatistics/Cengage Learning, 2015 – 891p. 3.Wayne Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences/Wiley, 2020 – 960p. 4. Glantz S. Medico-biological statistics. Per. from English. - M., Practice, 2012. — 459 p. (In Russian)

	5. Krupin V.G. Higher mathematics. Probability theory, mathematical statistics, random processes. Collection of problems with solutions: textbook - M .: MPEI Publishing House, 2013.-520 p. (In Russian) 6. Biyasheva Z.M., Lovinskaya A.V., Dauletbaeva S.B., Kalimagambetov A.M. Statistical methods in biology with software // Textbook for biological specialties: Almaty - Kazak University, 2019. - 108 p.

Discipline designation	**Molecular biology**
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	University component *Biostatistics* *Genetics*
Teaching methods	*Lecture, Laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact* hours. *120 self-study hours*
Person responsible for the module	***Taipakova Sabira Myktybekkyzy,*** Senior Lecturer of the Department of Molecular biology and Genetics PhD
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	*Biochemistry* *Genetics*
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the molecular carriers of heredity, the structure and function of proteins and nucleic acids. **Learning outcomes:** - analyze the main objects of research in the field of molecular biology of the physical and chemical properties of the information macromolecules of the cell - proteins and nucleic acids. - analyze the structure of the gene, its expression, explore hereditary and non-hereditary variability, regulate intracellular molecular genetic mechanisms; - apply the mechanisms of storage and expression of genetic information at the level of molecular biology in genetic engineering; - systematically analyze the process of regulation of gene expression in prokaryotes and eukaryotes. - regulate gene expression in pro- and eukaryotic organisms; clone, detected DNA strands, based on in vitro mutagenesis methods.
Content	Biological significance of nucleic acids. Composition of nucleic acids. Rules for the structure, composition and types of

	nucleotides discovered by Chargaff. Macromolecular structure of the DNA molecule. The Watson and Crick model of double-stranded DNA. Methods for determining the order of nucleotides in the DNA chain. (Methods of Maxam-Gilbert and Sanger). Semi-conservative mechanism of DNA replication.Kornberg replication model. The direction and starting points of the replication process.Gene structure and molecular mechanism of transcription. Enzymatic apparatus of the transcription process. Genetic code and control of the gene. Regulation of gene expression. General view of the broadcast process. Types of RNA. Apparatus of the translation process. Milestones and Involved Elements Constitutional and inducible enzymes. Transcriptional regulation of gene expression. Jacob and Monod model.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Basic Cell and Molecular Biology. University of Wisconsin, Milwaukee. 2020 Open textbook library. 2. Watson J., Baker T.A., Bell S.P., Gann A., Levine M., Losick R. Molecular Biology of the Gene (7th edition), Cold Spring Harbor Laboratory Press, 2015, 9122 p. 3. Alberts B., Johnson A., Lewis J., Morgan D., Raff M., Roberts K., Walter P. Molecular Biology of the Cell. 6th edition.-Garland Science, 2015. -1465 p. 4. Molecular Biology (Interdisciplinary Approaches in Teaching and Research) [Text]: educational man. / A. I. Zhussupova, Z. G. Aytasheva, R. A. Islamov; Al-Farabi KazNU. - Almaty : Qazaq university, 2016. - 197 p. 5. Biyasheva Z.M., Lovinskaya A.V., Dauletbaeva S.B., Kalimagambetov A.M. Statistical methods in biology with software // Textbook for biological specialties: Almaty - Kazak University, 2019. - 108 p

M-9 Problems of biophysics

Module Objectives. Students will be able to:

- explain the most important physical processes occurring in living organisms based on the principles and theory of biophysics;
- to form interrelations of physical and biological aspects of living systems;
- use biophysical methods in the study of biological phenomena and patterns;
- analysis of the basic laws of biological processes, mechanisms of their regulation from the point of view of thermodynamics;
- demonstrate biophysical research methods in experimental biology to explain the most important biological processes;
- ultrasound imaging and analysis of fundamental results of magnetic resonance imaging;
- application of basic methods of biological analysis to solve biophysical problems;
- apply the acquired knowledge in practice to solve applied problems of modern biology;

Discipline designation	Biophysics
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	*Human and Animal Physiology, Biochemistry*
Teaching methods	*Lecture, Laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact* hours. *120 self-study hours*
Person responsible for the discipline	***Tuleukhanov Sultan Tuleukhanovich*** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences* ***Gumarova L.Zh.*** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences* ***Ussipbek Botagoz Abdihankyzy*** *Senior Lecturer of the Department of Biotechnology, Doktor of*
Language	*Kazakh, Russian, English*
Discipline objectives/intended learning outcomes	**Discipline objectives**: the purpose of the discipline: to form students' ability to conduct research on biological processes and phenomena from the position of biophysics on the basis of theoretical and applied thinking, knowledge and skills of working on modern biomedical, biophysical equipment. **Learning outcomes:** 1. know and understand the basic principles of cell biophysics and complex systems; basic physical laws underlying biological processes and phenomena;

	2. be able to explain the essence of the first and second principles of thermodynamics; Hess' law, principles of Prigogine and E. Bauer; 3. analyze the mechanisms of bioelectrical and photobiological processes; 4. explain the mechanisms of generation of biological rhythms; principles of electrical conductivity of biosystems 5. interpret the basics of radiobiology and the mechanisms of radiation injury; 6. apply the acquired theoretical knowledge and practical skills in the practice of their own research.
Content	The course "Biophysics" introduces students to the theoretical foundations and basic methods of molecular biophysics, the biophysics of membrane processes, the structure and functioning of biological membranes, the main methods for studying membrane processes, the theoretical foundations and main methods for studying photobiological processes, the theoretical foundations and basic methods of radiation biophysics , about the main biophysical methods of registration of indicators of functional activity, the application of the acquired knowledge and skills in solving professional problems.
Exam form	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Bibliography	1. Inyushin V.M., Tuleukhanov S.T., Gumarova L.Zh., Kulbaeva M.S. Shvetsova E.V. Ecological biophysics. Study guide. – Almaty: Kazakh University, 2016. – 100 p. 2. Inyushin V.M., Toleukhanov S.T., Kulbaeva M.S., . Gumarova L.Zh., Shvetsova E.V., Kayrat B.K. Tests in biophysics.Educational and methodical manual. – Almaty: Kazakh University, 2019. – 116 b. 3. Kovaleva L. V. Medical biophysics : textbook. manual / L. V. Kovaleva ; State med. un-t G. Semey. - 2nd ed. - Almaty : Aknur, 2019. - 324 p. 4. Orynbayeva Z.S., Tuleukhanov S.T., Gumarova L.Zh., Kulbaeva M.S., Shvetsova E.V. Introduction to the kinetics of biological processes: textbook - Almaty: Kazakh University, 2020. – 89 p. 5. Samoilov V.O. Medical biophysics: Textbook for universities. – St. Petersburg: SpetsLit, 2013. – 591 s 8. Tuleukhanov S.T., Inyushin V.M., Gumarova L.Zh., Kulbaeva M.S., Shvetsova E.V. Methodological guide to laboratory classes in biological physics. – Almaty: Kazakh University, 2015. – 122 p.

Elective Component

M-10 Applied problems of biology

Module Objectives. Students will be able to:

- characterize the essence of biological phenomena from the standpoint of ideas about homeostasis, adaptability, negentropy;
- distinguish structural elements of cells and tissues on fixed histological preparations and living objects;
- observe and record the presence, diversity, localization, movement, etc. biological objects in nature;
- work with instruments and equipment of a modern biological laboratory;
- use various methods of processing biological samples to solve applied problems of biology and ecology;
- have the skills to use the basic general biological laws and principles in the most important practical applications;
- have the skills to apply the basic methods of biological and biochemical analysis to solve applied environmental problems;
- skills of practical application of the acquired knowledge for solving applied problems of modern biology, as well as for solving problems related to providing environmental safety;

Discipline designation	Microbiology
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	Elective Component *Ecology of microorganisms*
Teaching methods	Lecture, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 1 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 30 Contact hours. 120 *self-study hours*
Person responsible for the module	**Ualieva Perizat Serikkazyevna** *Associate Professor of the Department of Biotechnology, Candidate of Biological Sciences*
Language	Kazakh / Russian
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plants

Module objectives/intended learning outcomes	**Discipline objectives:** To know the morphology, physiology, systematics, genetics and evolution of viruses, bacteria and microscopic fungi; **Learning outcomes:** the ability to work in groups, an interdisciplinary team on projects in the field of microbiology, to share responsibility for performing a certain part of scientific theoretical and experimental work in the field of biology; Own: technologies for collecting, analyzing, summarizing and interpreting scientific information. Students acquire practical skills: the ability to apply knowledge in practice, the ability to conduct experimental research in the field of microbiology
Content	Introduction, the world of microbes. The history of the development of microbiology. The works of scientists in the development of the science of microbiology. The shape of prokaryotic cells. Basic cellular forms, multicellular forms. Rare forms of microorganisms. Chemical composition of prokaryotic cells. The composition and structure of individual components of prokaryotes. Surface structures: glycocalyx (mucous membranes, capsules), fimbriae, saws, thorns. Prokaryotic movement. Fibers, axial filaments, sliding. Taxi drivers. The cell wall of prokaryotes. Firmicutes and gracilicutes are the cell membrane. Cytoplasmic membrane, structure and function. The structure of the nuclear apparatus. Intracellular compounds and spare substances. The resting state of your microorganisms. Isolation of populations of microorganisms. Types of nutrient media. Features of the growth of microorganisms. Ways of transport of nutrients. Basic batteries. Growth factor. Auxotrophs. Types of nutrition in the world of microorganisms. The process of metabolism in microorganisms. The general concept of metabolism. Enzymes of microorganisms. Anaerobic respiration. Electron donor and acceptors. Aerobic breathing. The influence of physical and chemical factors on microorganisms. The growth of microorganisms depends on temperature, water composition, osmotic pressure, pH of the medium. Microbial growth in the presence of molecular oxygen. Fermentation. Methods of fermentation of carbohydrates. Types of discoveries. Characteristics of microorganisms that cause fermentation. The use of sunlight by phototrophic microorganisms. Features of photosynthesis. Genetics of microorganisms. Phenotypic and genotypic variability. The genetic apparatus of prokaryotes. Viruses, properties of viruses. Specificity of the chemical composition of viruses. DNA viruses, RNA viruses. Viral infections.
Examination forms	Test Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.

Reading list	1. Shigaeva M.H., Tszyu V.L. Microbiology. Kazakh University, 2008 2. Yemtsev, V. T., E. N. Mishustin Fundamentals of microbiology. Moscow : Yurayt Publishing House, 2020. 3. A.V. Pinevich, A.K. Sirotkin. Virology. Saint Petersburg State University, 2020. 4. Abdieva G.Zh. Medical microbiology. Kazakh University, 2017 5. Kirbaeva D.K. Fundamentals of microbiology. Kazakh University, 2017 6. Zverev, Boychenko, Nesvizh: Microbiology, virology. A guide to practical exercises. Study guide. GEOTAR-Media, 2022

Discipline designation	Biology of individual development
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	Elective component *Cellular and tissue pathology* *Human and animal physiology*
Teaching methods	lecture, lab work
Workload (incl. contact hours, self-study hours)	Lectures – 15 hours 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 30 Contact hours. *120 self-study hours*
Person responsible for the module	**Salmurzauly Ruslan** *Senior Lecturer of Department Biodiversity and Bioresources PhD*
Language	Kazakh / Russian
Required and recommended prerequisites for joining the module	Human and animal physiology, Endocrinology General biology
Discipline objectives/intended learning outcomes	**Discipline objectives:** To know: the specific concepts of developmental biology and general laws of the structural organization of organs and systems of human organs. **Learning outcomes:** Acquaintance with the formation of gametes and morphological changes in the embryo and cytohistological mechanisms that ensure the process of its development; modern methods of control, visualization and correction of the main stages of human and animal embryonic development;
Content	Introduction. The place of the course "Applied Aspects of the Biology of Individual Development" among other biological disciplines; rphological and functional features of germ cells - eggs and spermatozoa, and gonads (testes and ovaries). Meiosis. Gametogenesis: spermatogenesis and oogenesis; Reproduction is the main factor limiting the efficiency of livestock production.

	Fertility different types and breeds of farm animals and methods of its increase; Classical and biotechnological methods of targeted regulation of the reproduction process. farming, animal husbandry and medicine.The main stages of artificial insemination in animals (on the example of a sheep). Hormonal stimulation of superovulation in females. Methods for in vitro cultivation of mammalian zygotes to the morula stage. Collection and cultivation of oocytes in vivo and in vitro. Methods of deep freezing and media used for cryopreservation. Natural and artificial hormonal regulation of the sexual cycle, the importance of environmental factors.History of animal cloning research. Cloning method using nuclear transfer. Methods of enucleation of oocytes. Reproductive cloning. Cloning of embryos, methods of obtaining monozygotic twins (microsurgical and aggregation). Embryonic cloning. Methods of embryonic cells in vitro. Cloning of somatic cells. Cultivation of somatic cells in vitr. Therapeutic cloning. Use of cell totipotency and erasure of epigenetic inheritance for cloning. Stem cells and prospects for their use in practice. Cloning problems: hypertrophy, early aging, the occurrence of tumors and teratocarcinomas, developmental disorders. Physiological and reparative regeneration. Epimorphosis, morpholaxis, compensatory and regenerative hypertrophy.
Examination forms	Test Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Gilbert S. Developmental biology. Publishing House "Mir", M., in 3 volumes, 2015, 823p. 2. Golichenkov V.A. Embryology / V.A. Golichenkov, E.A. Ivanov, E.N. Nikeryasov. –M.: Ed. Center Academy, 2014. 3. Korochkin L.I. Biology of individual development (genetic aspect): Proc. for stud. biologist. special / L.I. Korochkin. -M.: Publishing House of Moscow State University, 2012. -263 p. 4. Kuznetsov S.L. Lectures on histology, cytology and embryology: Textbook. / S.L. Kuznetsov M.K. Pugachev / M.: Medical Information Agency, 2014. - 432 p. 5. Nurtazin S.T., Vsevolodov E.B. Biology of individual development. Publishing House "Kazakh University" Almaty, 2005, 297s., 2011, 330s. (2nd ed., supplemented.). 6. Dondua A. K., Developmental biology: textbook - 2nd ed., Rev. and add. Publishing House St. Petersburg. 2018 7. Barres Michael J.F., Gilbert Scott F. (eds.) Developmental Biology. 12th edition. — Oxford University Press, 2020

	8. Devi V.S. (Ed.) Inderbir Singh's Human Embryology. 11th edition. - Jaypee Brothers Medical Publishers, 2018. - 374 p 9. El-Bawab F. Invertebrate Embryology and Reproduction. Academic Press, 2020. - 919 p

Discipline designation	Bioethics and radiation biology
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	Elective component *Biophysics*
Teaching methods	Lectures, seminars, laboratory classes
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for Seminar, total 30 Contact hours. *120 self-study hours*
Responsible teacher	**Gumarova Leila Zhanbolatovna** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences* **Kulbaeva Marzhan Susarovna** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences* **Shapovalov Yuriy Aleksandrovich** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	*Biophysics, Chronobiology, Neurophysiology and Immunology*
Discipline objectives/intended learning outcomes	**Discipline objectives:** the formation of competencies in accordance with the ideas of human interaction with nature and the legal aspects of bioethics, the ability to identify bioethical problems in the field of management of biological objects and the use of radiation in science and industry, in research and testing on animals, and understanding the mechanisms of the impact of ionizing radiation on living organisms. **Learning outcomes** - have an idea and understanding of the place and role of bioethics in the system of natural sciences; -know legal acts on bioethics and biosafety; - be able to apply their knowledge of radiobiology in practice in various institutions where knowledge of radiobiology is one of the requirements for a specialist. - evaluate the latest achievements in the field of radiobiology and the prospects for their use in various fields of practice and medicine; - use knowledge and radiobiology in solving theoretical, practical issues and performing research work to explain the most

	important biological processes, apply ethical research methods in experimental biology.
Content	When studying the discipline, students will study the following aspects: Knowledge of the nature of the effects of radiation on biological structures; the basic theory of the mechanisms of radiation damage, the basic laws of radiation damage and control methods radiosensitivity; new developments radiobiology and its development prospects and know legal acts on bioethics and biosafety
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Edward L.Alpen. Radiation Biophysics. // Academic Press; 2 edition. 1997, 517 p. 2. Gopal B. Saha. Physics and Radiobiology of Nuclear Medicine. Fourth Edition //Springer, 2013 3. Mothersill, Korogodina, Seymour. Radiobiology and Environmental Security // Springer Science + Business Media. 2012. 4. Gumarova L.Zh. Radiobiology: Textbook. - Almaty: "Dauir", 2011. – 176 pages 5. YarmonenkoS.P., Wainson A.A. Radiobiology of human and animals: Textbook. 2004. - 549 pages 6. Yarmonenko S.P. Radiobiology of humans and animals: Textbook. for biol. specialist. universities. - 3rd ed., Revised. and add. - M .: Higher. Shk., 1988 .--424 p. 7. Recommendations of the European Committee on Radiation Risk. // Ed. Chris Busby // Center for Environmental Policy of Russia. - 2003, 220 p Internet resources: Electronic library of KazNU - https://elib.kaznu.kz/ Electronic library - http://elibrary.ru/ Website of the Faculty of Biology of Moscow State University - http://www.bio.msu.ru

M-10 Ecology and ethics

Module Objectives. Students will be able to:

- to systematize and present the latest achievements in the field of ecology and ethics and the prospects for their use in various fields of practice and medicine, through the content of the discipline to form in students an idea of life (a living organism) as a complex, holistic, developing natural system;
- on the basis of subjectivist-activity approaches to promote the development of students' ethical views in relation to all living things;
- demonstrate the content and structure of bioethics, its interdisciplinary and ideological nature of bioethics, the application of its principles in their daily work;
- systematize the diversity of animals, their main patterns of formation, find the place and role of animals in ecological systems, determine their economic, medical and commercial importance and form an ethical attitude towards all living things;
- demonstrate ethical methods in zoological research, morphology and structure of organ systems, evolution and taxonomy of the main representatives of invertebrates;
- analyze the needs of a person as an evolutionarily established system, as the basis for motivating his activity and identify the moral and legal problems of interference in biological
- human nature;
- to use the main methods of studying animal and plant communities of different landscape zones, the diversity of species composition of ecobiotopes, methods of collecting living objects;
- to interpret ideas about bioethics as an ideology of environmental protection, protection of living organisms, connection of bioethics with social problems of a person;

Discipline designation	Ecology of microorganisms
Credit points	6
Semester(s) in which the module is taught	5
Relation to curriculum	Elective component *Microbiology*
Teaching methods	*lectures, seminars, laboratory classes*
Workload (incl. contact hours, self-study hours)	Lectures – 15 hours 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 30 Contact hours. *120 self-study hours*
Person responsible for the discipline	**Omirbekova Anel** *Professor of the Department biotechnology, PhD*
Language	Kazakh, Russian,
Required and recommended prerequisites for learning the module	Microbiology
Discipline objectives/intended learning outcomes	**Discipline objectives:** is to form in students the ability to conceptualize the role of microorganisms in preserving the natural balance: **Learning outcomes**

	– to analyze and evaluate environmental issues associated with the implementation of biology development. – show the value of microorganisms in the preservation of natural equilibrium, owing to their active participation in the circulation of substances in nature. – to identify environmental problems of the environment associated with wastewater pollution, air and soils whose solution requires the use of biology. to put into practice a complex of modern research methods in environmental for the treatment of waste water and soil.
Content	Biological methods of wastewater treatment and solid waste management; aerobic and anaerobic processes of wastewater treatment, solid waste recycling through composting, bioremediation, methods and technologies of bioremediation; bioremediation of contaminated soils and soils, bioremediation of environmental, environment, cleaning from oil and petroleum products, bioremediation of the atmospherem, biotechnology in the solution of energy problems, biomethane, the production of bioethanol and other alcohols, prospects for hydrocarbons based on biological systems, biological production of hydrogen, new approaches to produce biofuels, biotechnology and the greening of agricultural technologies; biopesticides and biofertilizers.
Exam form	*Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes*
Reading list	1. Shigaeva M.H., Tszyu V.L. Microbiology. Kazakh University, 2008 2. Yemtsev, V. T., E. N. Mishustin Fundamentals of microbiology. Moscow : Yurayt Publishing House, 2020. 3. A.V. Pinevich, A.K. Sirotkin. Virology. Saint Petersburg State University, 2020. 4. Abdieva G.Zh. Medical microbiology. Kazakh University, 2017 5. Kirbaeva D.K. Fundamentals of microbiology. Kazakh University, 2017 6. Zverev, Boychenko, Nesvizh: Microbiology, virology. A guide to practical exercises. Study guide. GEOTAR-Media, 2022

Discipline designation	Human ontogenesis
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	Elective component *Genetics* *Human and animal physiology*

Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 4 hours per week for laboratory classes, total 30 Contact hours. *120 self-study hours*
Person responsible for the discipline	**Abdullayeva Bagilla Aidarovna** *Senior lecturer of Department Biodiversity and Bioresources, Candidate of Biological Science;*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	Biology of individual development
Discipline objectives/intended learning outcomes	**Discipline objectives:** is to study students with an in-depth understanding of the main patterns and features of pre- and postnatal ontogenesis of the human body, to acquaint them with the patterns of reproduction and individual development of organisms as a fundamental basis of life processes. **Learning outcomes** - the main patterns of ontogenesis at all stages of embryonic development, molecular biological, genetic, cellular and tissue mechanisms; - be able to understand macro- and micro-morphological, physiological and biochemical processes occurring in developing organisms; - have basic knowledge in the field of developmental biology, understand the social significance of this knowledge, be able to predict the consequences of their professional activities; - systematize and have ideas and understanding about the morphogenesis and cyto-differentiation of the embryo and the causes of developmental anomalies; - demonstrate the ability and readiness to use in practice the knowledge gained about the mechanisms of morphophysiological - differentiation of the organism in ontogenesis; - analyze critical periods in the development of humans and other representatives of mammals; show the possible role of violation of the external environment, ecology; - be able to apply and involve the acquired knowledge to solve scientific and practical problems, evaluate the latest achievements in the field of ontogenesis and the prospects for their use in various fields of practice and medicine.
Content	When studying the discipline, students will master the following aspects: the processes of ontogenesis, going through the entire life cycle, from zygote to death, phases of embryonic development, growth mechanisms, morphogenesis, differentiation and integration of parts of a developing organism.
Exam form	*Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of*

	students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	1.Chentsov Yu.S. Introduction to cell biology. Textbook. M., Moscow State University, 2014. 494 p. 2. Zavarzin A.A., Kharazova A.D., Molitvin M.N. Cell biology: general cytology. SPb.: Izd-vo SPb. Un-ta, 1992, 239 p. 4. Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988. 5. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 6. Afanasyev Yu.I. etc. Histology. M., 2000, 678p.

Discipline designation	Environmental ethics and the impact of physical fields on a living organism
Credit points	6
Semester(s) in which the module is taught	6
Relation to curriculum	Elective component *Biophysics*
Teaching methods	Lecture, Seminar
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Seminar, total 30 Contact hours *120 self-study hours*
Person responsible for the discipline	**Gumarova L.Zh.** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences* **Kulbaeva Marzhan Susarovna** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences* **Shapovalov Yuriy Aleksandrovich** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Sciences*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	Biophysics
Forms of study	*Lectures, seminars, laboratory classes*
Discipline objectives/intended learning outcomes	**Discipline objectives:** to form knowledge about the place and role of bioethics in the system of natural sciences; guidelines and legal acts on bioethics and biosafety, ideological and specific scientific foundations of bioethics, the history of its formation and interpretation in various sociocultural conditions; formation of skills for setting and solving bioethical problems in accordance with modern regulatory documents of different status and understanding the mechanisms of the impact of physical fields on living organisms. **Learning outcomes**

	-know legal acts on bioethics and biosafety; - be able to apply their knowledge on the action of external electromagnetic and other fields in practical activities in various institutions where knowledge of radiobiology is one of the requirements for a specialist. - evaluate the latest achievements in the field of the impact of physical fields on a living organism and the prospects for their use in various fields of practice and medicine; - use the knowledge of bioethics and physical factors of the environment in solving theoretical, practical issues and performing research work to explain the most important biological processes, apply ethical research methods in experimental biology.
Content	When studying the discipline, students will study questions of bioethics to solve educational problems to promote a healthy and safe lifestyle, environmental education of students, as well as the nature of the effects of radiation on biological structures, to develop an understanding of the mechanisms of radiation damage, the basic laws of radiation damage.
Exam form	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Инюшин В.М., Тулеуханов С.Т., Гумарова Л.Ж., Кулбаева М.С. Швецова Е.В. Экологическая биофизика. Учебное пособие. – Алма-ты: Қазақ университеті, 2016. – 100 стр. 3. Gumarova L.Zh. Radiobiology: Textbook. - Almaty: "Dauir", 2011. – 176 pages 4. YarmonenkoS.P., Wainson A.A. Radiobiology of human and animals: Textbook. 2004. - 549 pages 5. Физиология человека: учебник для медвузов / под ред.: В. М. Покровского, Г. Ф. Коротько. - 2-е изд., перераб. и доп. - М. : Медицина, 2007. - 655 с.

MAJOR DISCIPLINES
University component

M-11 Genetics and private physiology

Module Objectives. Students will be able to:

- interpret their knowledge about the cytological basis of heredity and variability, the structure of the gene, patterns of inheritance, types and causes of variability;
- own genetic terminology and be able to explain the fundamental laws of genetics and make a family tree;
- have the skills to predict the manifestations of hereditary diseases in offspring and phenotypically diagnose genetic pathologies;
- solve genetic problems for different types of inheritance and plan the prospects for their use in various fields of practice and medicine;
- use the methods and knowledge of genetics and private physiology in solving theoretical, practical issues and performing research work;
- demonstrate physiological research methods in experimental biology to explain the most important biological processes;
- analyze the theoretical and practical significance of genetics and private physiology, their relationship with other biological and natural sciences;
- determine genetic or physiological patterns in ongoing independent observations and experiments, be able to analyze and generalize and formulate conclusions on the observed phenomena;

Discipline designation	*Genetics*
Credit points	*9*
Semester(s) in which the discipline is taught	*5*
Relation to curriculum	University component *Genetics and private physiology*
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *4 hours per week for Laboratory work, total 60 Contact hours.* *180 self-study hours*
Person responsible for the discipline	***Zhunusbayeva Zhazira Kabulovna*** *Acting Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science* ***Omirbekova Nargul Zhapparovna*** *Professor of Department Molecular Biology and Genetics, Doctor of Biological Science* ***Chunetova Zhanar Zhumabekovna*** *Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science;*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	*School course in biology*

Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to understand the key mechanisms of heredity and variability of living organisms and use this knowledge in professional practice. **Learning outcomes***:* - demonstrate knowledge of the patterns of inheritance, forms of variability, genetics of sex and sex-linked inheritance; - understand the mechanisms of interaction of allelic and nonallelic genes, crossing-over, inheritance in the population, basis of human genetics; - analyze molecular biological processes that regulate the ways of transmitting and modifying hereditary information in pro- and eukaryotes; - acquire practical skills of making experiments on mono- and hybrid hybridization of *Drosophila melanogaster*; staging crosses on the interaction of nonallelic genes and the sex-linked inheritance; conducting hybridological analysis; - understand the perspectives and practical significance of genetics for medicine, agriculture, environmental protection and biotechnology.
Content	Subjects and Methods of Genetics. Categories of heredity and variability. Branches of Genetics. Genetic objects. The history of Genetics. Model organisms used in Genetics. The basic genetic concepts. Genetic symbols. Monohybrid crossing. Mendel's laws for monohybrid crosses. The types of allelic genes interactions. Di-and polyhybrid crosses. The third law of Mendel. Principles of inheritance of polyhybrid crosses. The cytological basis of Mendel's laws. The general formula for the independent inheritance splitting. The interaction between nonallelic genes. The statistical nature of splitting. The chi-square test. Lethal genes. Modifier genes. Allelic genes interactions. Complete dominance, incomplete dominance, codominance, and superdominance. Sex determination and sex-linked inheritance. Nondisjunction of sex chromosomes. Regulation of sex. Non-allelic genes interactions. Epistasis, complimentary, polymerism, and pleiotropy. Linkage and crossing over. Genetic evidence of crossing over. The genetic mapping of chromosomes. Regulation of crossing over. Chromosome theory of heredity. Extra-nuclear inheritance. Mobile elements of the genome. Hereditary and non-hereditary variability. Mutation theory of Hugo de Vries. Classification of mutations. Modifications and the rate of reaction. The Vavilov's law of variability homologous series. The molecular basis of heredity. DNA replication. The genetic code. Mechanisms of transcription. Translation mechanisms. DNA repair mechanisms and its significance in the mutation process. Evolution of the gene understanding theories. The fine structure of the gene. Gene functions. Genomic mutations. Chromosomal rearrangements. Gene mutations. Spontaneous and induced mutagenesis. Methods of study and accounting of mutations. Physical factors of mutagenesis. Chemical mutagenesis. Biological factors of mutagenesis. Genetics of populations. Hardy-Weinberg Equilibrium. Factors influencing

	on population structure. Genetic methods of selection process. Types of selection. Inbreeding. Heterosis. Genetics of Human. Medical genetics. Modern methods of genetic engineering and gene editing. Clones and chimeras. Modern methods of gene engineering and their practical usage.
Examination forms	*Written standard exam or Test* Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	1. William S Klug, Michael A Palladino, Michael R Cummings, Charlotte A Spencer. Concepts of Genetics. Pearson new international edition. Pearson Copyright – 2015. 2. Daniel L. Hartl. Essential of genetics: A Genomics Perspectives. Sixth Edition. Jones and Bartlett Publishers. Sudbury, Massachusetts. USA. 2012. 3. Isaeva A. U. , Isaev E. B. Genetics: a textbook. - Almaty : TechSmith, 2021. - 215 p. (In Kazakh) 4. Zhimulev I.F. General and molecular genetics. Textbook for universities. - N.: Publishing House of Novosibirsk University, 2012 5. Klug, Cummings M. Fundamentals of genetics. - M.: Technosphere, 2012.- 896 p 6. . General genetics: A methodological guide. Ed. Inge-Vechtomova S.G. St. Petersburg.: Publishing house N-L, 2015. - 124 p. (In Russian)

Discipline designation	Human and animal physiology
Credit points	*9*
Semester(s) in which the discipline is taught	*5*
Relation to curriculum	*University component* Cell Biology and histology Morphology of humans and animals
Teaching methods	*Lecture, laboratory work*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *180 self-study hours*
Person responsible for the discipline	**Srailova Gulziya Turapovna** *Associate Professor of Department of Biophysics, Biomedicine and Neuroscience* *Candidate of Biological Sciences* **Atanbaeva Gulshat Kapalbayevna**

	Professor of Department of Biophysics, Biomedicine and Neuroscience *Candidate of Biological Sciences*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	Cell Biology and histology Morphology of humans and animals Human ontogenesis Biology of individual development
Discipline objectives/intended learning outcomes	**Discipline objectives**: the form of ability to analyze the physiological characteristics of the body to assess the functional state of individual systems and the body as a whole **Learning outcomes:** - Understand and explain the life processes of the animal organism in their unity and relationship with the environment; general patterns and specific features of the activity of various body systems and their individual structural elements; - Describe and substantiate the mechanisms of physiological regulation of the vegetative functions of the body; mechanisms that ensure the interaction of individual systems of the body and the body as a whole with the external environment; - Apply in practice various experimental methods for studying the physiological functions of the body; evaluate the functional states of physiological systems and the whole organism, interpreting the results of the study; - Assess and argue the importance of physiological research for an objective characterization of the functional state of the body; - Synthesize information on human physiology based on theoretical and methodological principles and techniques for assessing and describing the physiological state of the body; - Analyze the dynamics of solving scientific problems in the field of physiology; make an analysis of the research results, summarize them in the form of a scientific essay, presentation, review, scientific review, etc.;
Content	The following questions are studied in the course: The subject of animal physiology, the object and methods of research. Principles of organization of control functions Basic methods of physiological experiment. Acquaintance with the apparatus of a physiological experiment, tools. Physiology of excitable tissues. Physico-chemical mechanisms of the emergence of the rest potential and action potential. Physiology of muscle tissue. The mechanism of muscle contraction Hormonal regulation of physiological functions. Physiology of the blood system Physiology of the circulatory system. Physiology of the heart. Physiological features of the heart. Physiology of respiration. Mechanisms of external respiration. Physiology of the respiratory center. Features of the digestive system of farm animals Metabolism and energy. Thermoregulation Physiology of excretion. Kidneys and their functions. Physiology of analyzers The doctrine of signal systems. Physiology of sensory systems. Types of higher nervous activity.

Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Normal physiology / Aghajanyan N.A., Smirnov V.M..- 3rd edition. - M.: Academy, 2010. 2. Human and animal physiology: textbook for universities / author: Apchel V.Ya., Darinsky Yu.A., - M.: Academy, 2011 3. Markeeva S.S., Srailova G.T., Askarova Z.A. Guide to laboratory classes in human and animal physiology: Textbook. Almaty, 2012 4. Solodkov A.S., Sologub E.B. Human physiology. General. Sports. Age group: textbook. – 4th edition: 5. Human biorhythms. Physical, emotional, intellectual. – M.: Armita-Rus, 2009. - 352 p.

Discipline designation	Chronobiology, Neurophysiology and Immunology
Credit points	*9*
Semester(s) in which the discipline is taught	*7*
Relation to curriculum	*University component* Human and animal physiology
Teaching methods	*Lecture, Seminar*
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *180 self-study hours*
Person responsible for the discipline	**Tuleukhanov Sultan Tuleukhanovich** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences* **Atanbaeva Gulshat Kapalbayevna** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences* **Bahtybaeva Layla Kirgizbaevna** *Associate Professor of Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	*Morphology of humans and animals* Physiological and biophysical mechanisms of adaptation and kinetics of drugs Growth physiology and endocrinology
Discipline objectives/intended learning outcomes	**Discipline objectives**: The purpose of the discipline: to form students' ideas about physical and biological time, understanding the basic concepts of chronobiology and the ability to determine the parameters of biorhythms using the example of circadian rhythms, understanding the patterns of the immune response, patterns of neurobiology. **Learning outcomes:**

	– explain the essence of the concept of time in the physical and biorhythmological senses based on the idea of fundamental principles and levels of biological organization, regulatory mechanisms at each level – have an idea about the stability and instability in the existence of organisms and supraorganismal systems, about the mechanisms of the relationship between the organism and the environment and their rhythmic organization, about the structure and nature of biorhythms and their classification – be able to assess desynchronosis and be able to recommend adequate measures to reduce it when changing time zones – have an idea about the grounds for chronobiological expertise, methods of analysis and modeling of biorhythmological processes; – be able to substantiate, analyze and discuss the concepts and theories of modern biology, including the theory of the biological clock and the problems of aging
Content	The ideas about the nature of biological rhythms.About the synchronizing factors of biological rhythms. About the role of rhythms as a mechanism of adaptation in the life activity of organisms from the simplest to humans. The ability to explain and systematize the general laws and specific features of the activity of the time system. Their individual structural elements and the organism as a whole.
Examination forms	*Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2-3 questions, time of preparation for the answer – 10-20 minutes*
Reading list	1. Chronobiology and chronomedicine/ collective of authors; edited by S.M. Chibisov, S.I. Rapoport, M.L. Blagonravov, M.: RUDN, 2018 – 828 p. : 2. Human physiology: textbook for medical schools / ed.: V. M. Pokrovsky, G. F. Korotko. - 2nd ed., reprint. and additional - M. : Medicine, 2007. - 655 p. 3. Biolocation, bioenergetics, biorhythmology in sports and in daily life. – M.: Amrita, 2012. - 160 p. 4. Human biorhythms. Physical, emotional, intellectual. – M.: Armita-Rus, 2009. - 352 p. 5. Human biorhythms. Physical, emotional, intellectual. – M.: Armita-Rus, 2009. - 352 p.

M-12 Fundamentals of bioresource conservation

Module Objectives. Students will be able to:

- demonstrate and investigate the main stages of the plant and animal world, their regularity of structure and dynamics. To learn the history of economic development of certain groups and types of useful plants and animals in Kazakhstan;
- analyze the resource types of plants and animals, products obtained from them.
- systematize concepts and terms related to biological resources, diversity of resource species, learn to systematize their morphological, biological and ecological features;
- explain the theoretical and methodological foundations of plant and animal bioresources;
- analyze the relationship between the dead and living nature, the relationship between the various components of wildlife, the main directions of modern ecology;
- to form ideas about the conservation of plant and animal resources;
- demonstrate the main methods of analyzing the activities of laboratories, compiling a report on production practices, the main legislative and regulatory documents and materials regulating the activities of enterprise management;
- analyze the results of practice obtained by domestic researchers on the design and organization of curricula;

Moduledesignation	Bioresources of Kazakhstan
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	University Component *Bioresources of Kazakhstan*
Teaching methods	lecture, lab work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *120 self-study hours*
Person responsible for the module	**Nurmahanova Akmaral Sadykovna** *Associate Professor of the Department of Biodiversity and Bioresources, PhD*
Language	*Kazakh, Russian*
Required and recommended prerequisites for joining the module	Vertebrate Zoology and higher plants
Discipline objectives/intended learning outcomes	**Discipline objectives:** Familiarization of students with the diversity of the plant world of Kazakhstan, the types of useful plants in Kazakhstan and groups for their development, as well as methods of using raw materials, regions for its development. **Learning outcomes:**

	- to acquaint students with the diversity of resources in the flora and fauna of Kazakhstan. -to study the main stages of the plant and animal world, their pattern of structure and dynamics. -to learn the history of economic development of certain groups and species of useful plants and animals in Kazakhstan. -to study the methods of obtaining raw materials, the scope of their application, practical significance. -to study the main stages of the plant and animal world, their pattern of structure and dynamics.
Content	A brief analysis of the state of biodiversity in Kazakhstan. Bioresources of the plant world. Effective use of plant resources in Kazakhstan and directions and stages of scientific research in this area. History and directions of research, development of various useful plants in Kazakhstan. Scientists who laid the foundation for the study of plant resources of Kazakhstan and the prospects for resource research work. Medicinal plants and their introduction into health practice. Preparation of raw materials of Medicinal Plants. Chemical composition of Medicinal Plants.
Examinationforms	Writing Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Readinglist	1. Mukhitdinov N.M., Eszhanov B.E., Satybaldieva G.K., Tynybekov B.M. // Kazakhstan Bioresources. Oku kuraly. Almaty: Kazakh University, 2016. – 81 p. 2. Mukhitdinov N.M., Parshina G.N. Medicinal plants. Almaty, 2002, 312 p. 3. Sokolov P.D. Botanical resource studies. To the 60th anniversary of the USSR. The journal "Plant resources". 1982, vol.XVIII, issue 4, pp.393-491. 4. Shukhobodsky B.A. About the term "Plant resources" and its application. Journal of Plant Resources, 1972, vol.XIII, pp. 432-435. 5. Methodology for determining stocks of medicinal plants. M.1986, 51 p. 6. Resources of medicinal plants of East Kazakhstan. Alma-Ata, 1984, 28-38 bb. 7.

Elective Component

M-13 General questions of biology

Module Objectives. Students will be able to:

- to systematize and present the latest achievements in the field of modern biology, to use their prospects for application in various fields of practice and medicine;
- use the methods and knowledge of the main sections of modern biology to solve practical issues and carry out research work;
- demonstrate knowledge of modern research methods in experimental biology to explain the most important biological processes;
- apply knowledge of the principles of cellular organization of biological objects, biophysical and biochemical foundations, membrane processes and molecular mechanisms of life;
- own modern methods of working with biological objects in the field and or laboratory conditions; methods of anatomical research skills of working with microscopic equipment, methods of description organisms; a complex of laboratory methods for the study of animals and plants; modern apparatus and equipment for performing studies of biological objects;
- analyze the theoretical and practical significance of modern biological sciences and their relationship with other natural sciences;
- critically evaluate professional and social experience; set goals and objectives for the implementation of specific work; be persistent in achieving the goals and objectives; to bring what has been started to its logical end;
- build promising lines of self-development and self-improvement; use modern information technologies to acquire knowledge in the field of their own research;

Moduledesignation	**Plant ecology and theory of evolution**
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	**Elective component** *Plant ecology and theory of evolution*
Teaching methods	**Lecture, laboratory work**
Workload (incl. contact hours, self-study hours)	Lectures - 15 hours 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for laboratory , total 60 Contact hours. *180 self-study hours*
Person responsible for the module	***Akhtayeva Nursulu Ziyakhanovna****, Associate Professor of the Department of Biodiversity and Bioresources, Candidate of Biological Science* ***Kalimagambetov Aitkali Mazhitovich*** *Senior Lecturer of Department Molecular Biology and Genetics, Candidate of Biological Science; Candidate of Biological Science* ***Omirbekova Nargul Zhapparovna*** *Professor of Department Molecular Biology and Genetics, Doctor of Biological Science, Candidate of Biological Science*
Language	*Kazakh, Russian, English*

Required and recommended prerequisites for joining the module	Morphology and anatomy of plants, the taxonomy of lower and higher plants.
Discipline objectives/intended learning outcomes	**Discipline objectives:** To form students' knowledge of determining the influence of various environmental factors on plants and identifying adaptations that contribute to the normal development of plants in a variety of environmental conditions. **Learning outcomes** - systematize knowledge about the main factors, mechanisms and laws of evolutionary processes; - analyze facts and data on the evolution of living organisms at the level of micro- and macro-evolution; - understand the main points of the synthetic theory of evolution; - use the evolutionary approach in the analysis of specific biological facts and phenomena.
Content	Introduction to the course of plant ecology. Interaction of plants with the environment. Intraspecific ecological subdivisions. Ecological morphology of plants. Mechanisms of plant adaptation to abiotic factors Light as an environmental factor. Heat as an environmental factor. Water as an environmental factor. Air as an environmental factor. Soil and orographic factors. Biological and technological aspects of plant ecology.Biotic factors. Human influence on plants. Periodic phenomena in plant life. Ecological bases of plant cultivation. Ecological groups of plants of the Republic of Kazakhstan. The history of the emergence and development of evolutionary ideas. Genetic, ontogenetic and ecological bases of evolution. Elementary factors, mechanisms and patterns of evolution of living, causes and mechanisms of micro- and macroevolutionary processes. Evolution of organs and functions;philocoenogenesis and the causes for the direction of the evolutionary process. Criticism of evolutionary theory. The world-view value of the theory of evolution. Human evolution.
Examinationforms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Readinglist	1. Garitskaya M. Yu. Ecology of plants, animals and microorganisms [Electronic resource]: textbook. allowance / M. Yu. Garitskaya, A. A. Shaikhutdinova, A. I. Baitelova - Electron. text data. - Orenburg: Orenburg State University, EBS DIA, 2016. - 346 p. Access mode: http://www.iprbookshop.ru/61425.html. 2. Demina M. I. Geobotany with the basics of plant ecology and geography [Electronic resource]: textbook. allowance / Demina M.I., Solovyov A.V., Chechetkina N.V. - Electron. text data. - M.: Russian State Agrarian Correspondence University, 2013. - 148 p. Access mode: http://www.iprbookshop.ru/20643 3. The study of plant populations on industrial dumps [Electronic resource]: textbook. allowance / M. A. Glazyrina

	[and others]. – Electron. text data. - Yekaterinburg: Ural Federal University, 2016. - 228 p. Access mode: http://www.iprbookshop.ru/66153.html 4. Kalashnikova L. M. Laboratory workshop on plant ecology [Electronic resource] / L. M. Kalashnikova. – Electron. text data. - Nalchik: Kabardino-Balkarian State University, 2013. - 47 p. Access mode: http://www.iprbookshop.ru/47679.html 5. Afanas'eva N. B. Introduction to plant ecology / N. B. Afanas'eva, N. A. Berezina. - M.: Publishing house of Moscow State University, 2011. - 800 p. 6. Van Wyhe, John. Darwin: The Story of the Man and His Theories of Evolution, London: Andre Deutsch, 20013 – 387p. 7. Warwick Collins. A Silent Gene Theory of Evolution, University of Buckingham Press, 2014 – 151p.

Discipline designation	**Photobiology and differentiation of cells**
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	Elective component *Photobiolo-gy and differentiation of cells*
Teaching methods	Lecture, laboratory works
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for laboratory, total 60 Contact hours. *180 self-study hours*
Person responsible for the discipline	**Tuleukhanov Sultan Tuleukhanovich** *Professor of the Department of Biophysics, Biomedicine and Neuroscience, Doktor of Biological Science* **Akhmetova Aigul Bazylbekovna** *Professor of Biological Sciences of the Department of Biophysics, Biomedicine and Neuroscience, Candidat of Biological Science*
Language	*Kazakh, Russian, English*
Required and recommended prerequisites for joining the discipline	Biochemistry, Human and animal physiology, Chronobiology, Neurophysiology and Immunology
Discipline objectives/intended learning outcomes	**Discipline objectives:** to form ideas about the physicochemical foundations of photobiological processes (photosynthesis, vision, chemiluminescence, etc.) and the mechanisms of cell differentiation, as well as methods for studying these phenomena (microscopy, spectrophotometric, colorimetric methods, luminescent analysis, etc.) and the ability to apply methods of photobiological effects on living organisms and cell differentiation. **Learning outcomes:** - have an idea and understanding of the general principles and basic physical and chemical mechanisms of the action of light on biological systems of different levels of organization and the mechanisms of the main photobiological processes.

	- be able to apply knowledge of the basics of photobiology to solve theoretical and practical problems at the level of reproduction (according to instructions and basic formulas), - be able to carry out photometric analysis using microscopy, spectrophotometric, colorimetric methods, luminescent analysis, etc.) - have basic skills in working on experimental equipment and analyzing the results obtained - evaluate the latest achievements in the field of cell differentiation and the prospects for their use in various fields of practice and medicine; - use knowledge of cell differentiation in solving theoretical, practical issues and performing research work to explain the most important biological processes, apply photometric research methods in experimental biology.
Content	When study the discipline, students will study the following aspects: the physical mechanisms of the primary stages of photo biological processes and spectroscopic methods, describe the reactions of organisms to the action of light (animal vision, phototaxis, phototropism, photoperiodism, the effect of light on the synthesis of vitamins, pigments, etc., photostimulation of growth and development, cell division); analyze the biological effect of ultraviolet radiation.
Examination forms	*Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes*
Reading list	1. Khodorov B.I. General physiology of excitable membranes. M., Nauka, 1975. 406 p. 2. Milaeva E.R. Bio-organic chemistry. Moscow State University, 2015. -384s. 3. Mironova I.K., Kanevsky M.V.. A short course of lectures on biophysics. Saratov 2017-412s. 4..Antonov V.F., Chernysh A.M., Kozlova E.K., Korzhuev A.V. Physics and Biophysics. Workshop: study. Manual. – M.: GEOTAR-Media, 2012. - 336 p. Internet resources: 1.http://lib.kaznu.kz/book/2511 2.http://lib.kaznu.kz/book/11943 3.http://lib.kaznu.kz/book/13015 4.http://lib.kaznu.kz/book/12691 5.http://www.library.biophys.msu.ru/rubin/ 6.https://educon.by/index.php/materials/phys/

Discipline designation	**Fundamentals of general parasitology**
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	Elective component Zoology of in invertebrates and lower plants
Teaching methods	Lecture, laboratory works
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for laboratory, total 30 Contact hours. *180 self-study hours*

Person responsible for the discipline	Shalgimbayeva S.M. *Acting Associate Professor of Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh, Russian*
Discipline objectives/intended learning outcomes	**Discipline objectives:** to form a holistic understanding of the diversity of species, their structure, biology and ecology of the main taxonomic groups, their role in ecosystems, economic and professional significance of the main representatives of animals, to apply the acquired knowledge in scientific work, production and economic fields, to have practical skills to conduct biological research. **Learning outcomes:** - work with textbooks on Systematics, ecology of the main types of nasekoms - know the places and regions of their distribution; - knowledge of the diversity of insects, their significance, features of their structure, types of reproduction, methods of distribution; - work with tools used in monitoring, selecting indicator types, in field conditions and in the laboratory, make presentations; - organization at the scientific level, which should be applied in the production and economic spheres; - assessment of theoretical and practical knowledge using scientific research and practical approaches in their professional activities, preparation of reports, abstracts;
Content	It is based on knowledge of the diversity of insects, their structure, biology and ecology of the main taxonomic groups, their role in ecosystems, the formation of a holistic understanding of the economic and professional significance of the main representatives of animals, the diversity of insects, their significance, features of their structure, types of reproduction, distribution characteristics.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1.Dautbaeva K. A. Zoology of invertebrates. Book 1-2: textbook. - Almaty: 2004 – - 376 P. 2.Dautbaeva K. A., Shalgymbaeva S. M. Zoology. Part I. Invertebrate zoology. Almaty, 2013. 3. Satybaldieva G. K., Ormanova G. zh., Baimurzaev N. B. Zoology of invertebrates (workshop): manual/ - Almaty: Kazakh University, 2014. – 148 P.

M-13 Herbs of Kazakhstan

Module Objectives. Students will be able to:

- to analyze theoretical and practical recommendations for the use of widely known medicinal plants of Kazakhstan in various fields of medicine;
- to use knowledge about the chemical composition of well-known medicinal plants of Kazakhstan.
- classify medicinal plants of Kazakhstan according to the composition of the basic rights.
- analyze the storage of medicinal plants, their rational use, possession of forms and methods;
- explain the use of medicinal plants in alternative medicine by its properties;
- explain the rules for the use of poisonous medicinal plants;
- is able to use methodological instructions and equipment bases for experiments;
- to use modern information technologies to improve knowledge in the field of pharmaceuticals;

Module designation	**Introduction of plants**
Credit points	**9**
Semester(s) in which the module is taught	**7**
Relation to curriculum	Elective Component *Vertabrate Zoology and higher plants* *Herbal Medicine* *Bioresourscer of Kazakhstan*
Teaching methods	lecture, seminar, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for Seminar, total 60 Contact hours. *180 self-study hours*
Person responsible for the module	**Nurmahanova Akmaral Sadykovna** *Associate Professor of the Department of Biodiversity and Bioresources, PhD*
Language	Kazakh
Required and recommended prerequisites for joining the discipline	Vertebrate Zoology and higher plants, Plant anatomy and morphology
Discipline objectives/intended learning outcomes	**Discipline objectives:** Formation of students ' ability to effectively use the knowledge gained in science and practice on the basis of ways of Plant Introduction, biological and environmental features of localized plants. **Learning outcomes:** - Classification of plant life forms; - Mastering the ways of plant acclimatization; - Distinguish between plant ecotypes; - Mastering the methods of introduction;
Content	Purpose and objectives of the discipline plant introduction. History of plant introductions. nalysis of introductory terms "reintroduction", "ex-situ storage", "in-sity storage", "acclimatization", "naturalization. Conducting natural and artificial introductions. Geographical areas of

	introductions. Life form of plants. Method of Comparative Study of the areals of paleoareals and modern introductions. Plant reproduction metabolism and energy storage and Exchange.The importance and features of the physiological adaptive reactions of introduced plants temperature resistance of the plant. Plant temperature resistance. Moisture and salt resistance of plants. Individual developmental biology of introduced plants. The concept of ontogenesis. Features of ontomorphogenesis of introducents. Ways to use agrotechnical methods in the introduction of biodiversity protection. The rhythm of growth and development. Phenology, phenophase, phenological observations. Method of ecogenetic analysis of introducents. Introduction of herbaceous plants. Introduction of Woody, shrubby and semi-shrubby plants preservation and introduction of the gene pool of fruit plants. Achievements of plant introduction in the main Botanical Garden of Almaty with prerequisites.
Examination forms	Writing Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Grinevich, M. A. Information search for promising medicinal plants / M.A. Grinevich. - M.: Nauka, 2019. - 142 p. 2. Annotated list of medicinal plants of Kazakhstan: Reference edition / L.M. Grudzinskaya, N.G. Gemedzhieva, N.V. Nelina, Zh.Zh. Karzhaubekova. – Almaty, 2018. – pp. 86-87 3. Anishchenko L.V. Decorative medicinal plants in garden design. M. Rostov n/A: March, 2018. 128 p. 5.Begenov A. B., Ametov A. A., Eszhanov B. E., Abidkulova K. T., Satybaldieva G. K., Tynybekov B. M., Baimurzaev N. B., Childibaeva, Nurmakhanova A. S. A. zh. methodological guidance on conducting educational practice on Botany. "I don't know," he said. Almaty.; Kazakh university, 2015. – 78 P 6.Nurmakhanova A. S., Childibaeva A. zh., Tynybekov B. M.,Nazarbekova S. T. Hydrobotany textbook. Kazakh University, Almaty, 2018. 175 7. Nurmakhanova A. S., Tynybekov B. M., Childibaeva A. zh., Nazarbekova S. T. water and coastal plants. Training manual. Almaty, Kazakh University 2021. - 122B.

Discipline designation	**Basics of general mycology**
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	Elective Component *Zoology of invertebrates and lower plants*
Teaching methods	Lecture, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 60 Contact hours. *180 self-study hours*

Person responsible for the module	**Nazarbekova Saltanat Tolepbekovna** *Associate professor of the Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh*
Required and recommended prerequisites for joining the module	Plant anatomy and morphology, Zoology of invertebrates and lower plants , Professional (educational-field) practice , Vertebrate Zoology and higher plants , Bioresources of Kazakhstan
Discipline objectives/intended learning outcomes	**Discipline objectives:** To form students' ability to use information about the structural, ontogenetic, cyto-biochemical features of fungi, as well as modern methods of their study to address issues of conservation of their biodiversity. **Learning outcomes:** • apply knowledge of fungal morphology when interpreting their ectomorphs; • analyze the mechanisms of adaptation of fungi to various environmental conditions; • use knowledge of fungal conidiogenesis when considering questions of fungal physiology; • analyze the issues of the state of biodiversity of the fungal population; • evaluate fungal biodiversity
Content	Subject and methods of studying mycology; The structure of fungi; Microscopic study of fungi; Reproduction of fungi; Fundamentals of fungal genosystematics; lassification schemes of mushrooms; Brief general information on the identification of fungi; Real fungi and fungi -like organisms; Characteristics of Zygomycetes and Chytridiomycetes and description of their most typical species; Characteristics of Dikaryomycetes;Department of Ascomicota; Department of Basidiomycota. Anamorphic fungi; Nutrition of mushrooms. Sources of carbon, nitrogen, mineral elements, vitamins and growth substances; Nutrient media and cultivation of fungi; Ecology of fungi
Examination forms	Traditional written exam. Theoretical and practical tasks on the topics of lectures, laboratory classes and independent work of students. Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Perevedentseva L.G. Mycology: Fungi and mushroom-like organisms: a textbook. 2nd ed., revised and supplemented - St. Petersburg: Publishing house "Lan", 2012. - 272 p. 2. Diseases of plants of the Iridaceae or Kasatikovye family (lat. Iridacea) caused by rust fungi. Kurgan State University, Kurgan, Russia, 2012, 40 p. 3. Vasser S.P. (ed.) Biological features of medicinal macromycetes in culture. Volume 1. Collection of scientific papers in two volumes. - Kyiv: Alterpres, 2011. - 212 p.

	4. Perevedentseva L.G. Mycology: Mushrooms and mushroom-like organisms: textbook / Perm State University - Perm, 2009. - 199 p. 5. Algology and mycology: Mushrooms and mushroom-like organisms: a practical guide for students. specialist. 1 - 31 01 01-02 - "Biology (scientific and pedagogical activity)" / V. A. Sobchenko [and others]; - Gomel: GSU im. F. Skorina, 2009. - 100 p. 6. A.V. Zachinyaeva, A.V. Moskalev, V.A. Andreev, V.B. Sboychakov. Medical mycology. 2nd edition, revised and enlarged. Guide for doctors. Moscow. Publisher: GEOTAR-Media. 2018. Beloshapkina O.O., Chebanenko S.I., Fundamentals of the classification of phytopathogenic fungi and pseudofungi. Methodical instructions. M.: publishing house of RGAU-MSHA named after K.A. Timiryazev. - 20 p.

Discipline designation	**Herbal Medicine**
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	Elective Component *Introduction of plants* *Bioresources of Kazakhstan* *Vertabrate Zoology and higher plants*
Teaching methods	Lecture, seminar, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 30 Contact hours. *120 self-study hours*
Person responsible for the module	***Mamurova Asem Tleuzhanova*** *Associate Professor of the Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh*
Required and recommended prerequisites for joining the module	Vertebrate Zoology and higher plants
Discipline objectives/intended learning outcomes	**Discipline objectives**: the main purpose of this discipline: to form students' knowledge about medicinal plants, their properties, application features; collection and processing rules; preparation of medicinal forms from plants. **Learning outcomes:** – application of knowledge about medicinal plants used in alternative medicine; – justification and explanation of the use of a medicinal plant in herbal medicine according to its properties; – determination of the forms and methods of collection, storage of medicinal plants, preparation of medicinal fees; – assessment of the possible risks of the joint use of drug therapy and herbal medicine;

	– conducting diagnostics of medicinal plant raw materials.
Content	Introduction. Subject herbal medicine, goals and objectives. Characteristics of medicinal plants from alternative medicine. Biologically active substances of plants. Pharmacological activity of plants. Medicinal plants and their definition. Rational use of stocks of medicinal plants. Methods of collecting and drying medicinal plants. Selection of medicinal plants for collection and preparation of medical fees. Study of the chemical composition of medicinal plants. Systematize the variety of medicinal plants depending on the composition of their BAF and properties. Determination of the medical value and medicinal properties of medicinal plants. Implementation of diagnostics of medicinal plant raw materials. Systematization of the latest knowledge in the field of the use of non-traditional medicinal plants in phytotherapy. Prospects for further study and use of medicinal raw materials.Creating a database.
Examination forms	Writing Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Mukhitdinov N.M. Geobotany. Almaty., 2019. 384 b. 2. Grinevich, M. A. Information search for promising medicinal plants / M.A. Grinevich. - M.: Nauka, 2019. - 142 p. 3. Annotated list of medicinal plants of Kazakhstan: Reference edition / L.M. Grudzinskaya, N.G. Gemedzhieva, N.V. Nelina, Zh.Zh. Karzhaubekova. – Almaty, 2018. – pp. 86-87 4. Anishchenko L.V. Decorative medicinal plants in garden design. M.; Rostov n/A: March, 2018. 128 p. 5. Mukhitdinov N.M., Eszhanov B.E., Satybaldieva G.K., Tynybekov B.M. // Kazakhstan Bioresources. Oku kuraly. Almaty: Kazakh University, 2016. – 81 p. 6. Mukhitdinov N.M., Parshina G.N. Medicinal plants. Almaty, 2002, 312 p.

M-13 Cell pathology and cell technology

Module Objectives. Students will be able to:

- analyze and classify individual organs, understand the topography of organs and their systems, demonstrate details of the structure of organs on dummies and natural preparations;
- demonstrate methods of generalization, analysis, perception of information about the holistic representation of the unity of the structure and functioning of a living organism in the process of its vital activity;
- explain the theoretical and methodological foundations of physiology, mechanisms and patterns of activity of vegetative functions of the body;
- analyze the mechanisms that ensure the interaction of individual parts of the body and the body as a whole with the external environment, prospects for the development of physiology and its practical application;
- use methodological instructions and equipment bases for experiments;
- analyze the theoretical and practical significance of modern biological sciences and their relationship with other natural sciences.
- demonstrate all types and mechanisms of innate nonspecific and acquired specific immunity, functional load of immunocompetent cells, stages of formation, growth and involution of lymphoid organs;
- report the knowledge gained in research work; analyze information from literary, basic information, electronic sources;

Discipline designation	Private Histology
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	Elective Component *Microscopic technique and human animal anatomy* *Human and animal physiology*
Teaching methods	Lecture, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 60 Contact hours. *180 self-study hours*
Person responsible for the module	***Abdullayeva Bagila Aidarovna*** *Senior Lecturer, Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh, Russian*
Required and recommended prerequisites for joining the module	Human and animal physiology Cell Biology and histology

Discipline objectives/intended learning outcomes	**Discipline objectives:** familiarization of students with the laws of the histological structure of organs. Students should learn general principles in the fine structure of animal and human organs; comprehend the unity of structure and functions **Learning outcomes:** - to explain the importance of microscopic anatomy for studying the morphology of various organs and systems; - to identify different types of cells and tissues in the composition of various organs; - to base on the basis of modern data of functional morphology the structure of various organs and systems; - to analyze the microscopic and submicroscopic structure of cells and tissues typical for these organs, to assess the state of various organs and systems of the organism in norm and in pathology; - to form representations about general laws of development of those or other structures in structure of an organ and an organism; - to use methods of histological analysis in scientific practice, to determine and distinguish between general and particular patterns of the morphofunctional organization of individual organs of the body.
Content	Histology and cytology, their content, tasks, connection with other sciences, significance. The doctrine of the cell. Organization of biomembranes, chemical composition of hyaloplasm, cytosol.Single-membrane cell organelles: endoplasmic reticulum (granular and agranular reticulum), lamellar complex, lysosomes, peroxisomes, spherosomes, vacuoles). Bioenergetics of the cell. Two-membrane cell organelles: mitochondria and plastids. Structure and function of mitochondria. Non-membrane cell organelles: ribosomes, cytoskeleton, cell center, cilia and flagella, inclusions. The structure and function of the cell nucleus. The structure of the nuclear envelope. Osteohistogenesis. Histological structure of the tubular bone. Muscle tissues, morphofunctional characteristics, classification. Nervous tissue The structure of a neuron. Neuroglia. Nerve fibres.
Examination forms	Test Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.

Reading list	1.Chentsov Yu.S. Introduction to cell biology. Textbook. M., Moscow State University, 2014. 494 p. 2. Zavarzin A.A., Kharazova A.D., Molitvin M.N. Cell biology: general cytology. SPb.: Izd-vo SPb. Un-ta, 1992, 239 p. 4. Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988. 5. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 6. Afanasyev Yu.I. etc. Histology. M., 2000, 678p. Additional: scientific journals: "Cytology", "Ontogeny", "Molecular biology", "Genetics" This literature can be obtained by subscription or in the reading room of the National Library of KazNU named after al-Farabi (see the map of the provision of educational literature) Internet resource: 1. elibrjry.kaznu.kz. 2. Cell Biology - Hypertextbook

Discipline designation	Cellular and tissue pathology
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	Elective component Microscopic technique and human animal anatomy Human and animal physiology
Teaching methods	lecture, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 90 Contact hours. *180 self-study hours*
Person responsible for the module	***Abdullayeva Bagila Aidarovna*** *Senior Lecturer, Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh, Russian*
Required and recommended prerequisites for joining the module	Stem cell biology Cell Biology and histology Human and animal physiology
Discipline objectives/intended learning outcomes	**Discipline objectives:** is the abnormality of tissues from the normal state and the process of development of metabolic processes in healthy tissues, proceeding differently depending on the state of the organism as a whole. **Learning outcomes:** – explain homeostasis, adaptation and typical forms of cell pathology;

	– based on modern data, to determine the standard forms of cell pathology: dystrophy, dysplasia, metaplasia, hypotrophy (atrophy), hypertrophy, as well as necrosis and pathological forms of apoptosis; – effects of endo and exogenous factors that cause cell damage; mechanisms of cellular alteration (disorders of cell energy supply, damage to membranes and enzymes, activation of free radical and peroxide processes, imbalance of ions and water, disorders in the genome or expression of genes, disorders in the regulation of cell functions); – to analyze and identify specific changes that develop when a particular pathogenic factor acts on different cells or in certain types of cells under the action of different damaging agents; to find and analyze the modern scientific literature on cellular pathology and scientific problems considered in this discipline; to highlight the most important problem issues and forecast possible solutions of them; – to form the skills of cytological analysis for detection of pathological processes, generalization, interpretation and evaluation of the observed structural changes at different levels of research (molecular, biochemical, subcellular, cellular, tissue). - study of pathological development processes in cells, tissues and organs in diseases, disruption of trophic tissue, atrophy, dystrophy. The study of damage to the tissues of the body, their death, arising in the body due to the aging of functioning biological structure
Content	The place and role of cell pathology in the system of biological and medical sciences; typical forms of cell pathology: dystrophy, dysplasia, metaplasia, hypotrophy (atrophy), hypertrophy, necrosis and pathological forms of apoptosis; factors that cause cell damage; mechanisms of cellular alteration and repair; mechanisms and ways to increase the resistance of cells to damage. The final stage of damage to the tissues of the body is their death. Necrosis - tissue and cell death as a result of pathological processes: traumatic necrosis, toxic necrosis, trophoneurotic necrosis, allergic necrosis, vascular necrosis, coagulative tight necrosis, colliquated necrosis. Study of the mechanisms of action of direct and indirect necrosis
Examination forms	Test Test in the “Univer” platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Zavarzin A.A., Kharazova A.D., Molitvin M.N. Cell biology: general cytology. SPb.: Izd-vo SPb. Un-ta, 1992, 239 p. 2. Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988.

	3. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 4. Afanasyev Yu.I. etc. Histology. M., 2000, 678p. 5Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 6. Afanasyev Yu.I. etc. Histology. M., 2000, 678p.

Discipline designation	**Stem cell biology**
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	Elective component Cell Biology and histology Human and animal physiology
Teaching methods	lecture, lab work
Workload (incl. contact hours, self-study hours)	15 weeks, 2 hour per week for Lecture, total 30 Contact hours. 2 hours per week for lab work, total 30 Contact hours. *120 self-study hours*
Person responsible for the module	***Abdullayeva Bagila Aidarovna*** *Senior Lecturer, Department of Biodiversity and Bioresources, Candidate of Biological Science*
Language	*Kazakh, Russian*
Required and recommended prerequisites for joining the module	Cell Biology and histology
Discipline objectives/intended learning outcomes	**Discipline objectives:** is the abnormality of tissues from the normal state and the process of development of metabolic processes in healthy tissues, proceeding differently depending on the state of the organism as a whole. **Learning outcomes:** – explain homeostasis, adaptation and typical forms of cell pathology; – based on modern data, to determine the standard forms of cell pathology: dystrophy, dysplasia, metaplasia, hypotrophy (atrophy), hypertrophy, as well as necrosis and pathological forms of apoptosis; – effects of endo- and exogenous factors that cause cell damage; mechanisms of cellular alteration (disorders of cell energy supply, damage to membranes and enzymes, activation of free radical and peroxide processes, imbalance of ions and water, disorders in the genome or expression of genes, disorders in the regulation of cell functions); – to analyze and identify specific changes that develop when a particular pathogenic factor acts on different cells

	or in certain types of cells under the action of different damaging agents; to find and analyze the modern scientific literature on cellular pathology and scientific problems considered in this discipline; to highlight the most important problem issues and forecast possible solutions of them; – to form the skills of cytological analysis for detection of pathological processes, generalization, interpretation and evaluation of the observed structural changes at different levels of research (molecular, biochemical, subcellular, cellular, tissue). study of pathological development processes in cells, tissues and organs in diseases, disruption of trophic tissue, atrophy, dystrophy. The study of damage to the tissues of the body, their death, arising in the body due to the aging of functioning biological structures.
Content	*The place and role of cell pathology in the system of biological and medical sciences; typical forms of cell pathology: dystrophy, dysplasia, metaplasia, hypotrophy (atrophy), hypertrophy, necrosis and pathological forms of apoptosis; factors that cause cell damage; mechanisms of cellular alteration and repair; mechanisms and ways to increase the resistance of cells to damage. The final stage of damage to the tissues of the body is their death. Necrosis - tissue and cell death as a result of pathological processes: traumatic necrosis, toxic necrosis, trophoneurotic necrosis, allergic necrosis, vascular necrosis, coagulative tight necrosis, colliquated necrosis. Study of the mechanisms of action of direct and indirect necrosis.*
Examination forms	Test Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions. Practical/lab work, creative. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of control are unacceptable.
Reading list	1. Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988. 2. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012. 3. Afanasyev Yu.I. etc. Histology. M., 2000, 678p. 4.Workshop on cytology/under the editorship of Yu.S. Chentsova. M.: Izd-vo MSU, 1988. 5. Alberts B., Bray D., Lewis D. Molecular biology of cells: in 5 volumes. M.: Mir. 2012.

M-13 Biology and ecology of animals

Module Objectives. Students will be able to:

- 1. analyze the latest achievements in the field of parasitology based on the duality of the parasite habitat;
- 2. use the basic theoretical concepts of forms of symbiosis, parasitism;
- 3. develop methods of prevention and control based on the symptoms and dynamics of epizootics;
- 4. systematize the main types of animals that lead a parasitic lifestyle and cause diseases of humans and farm animals;
- 5. determine the life forms of parasitic animals and navigate the life cycles of parasites of practical importance;
- 6. use methods of parasitological examinations and techniques for compiling parasitological descriptions;
- 7. demonstrate the ability to apply experimental methods of parasitological research in practice;
- 8. use the acquired knowledge in solving theoretical and practical problems in the field of modern parasitology;

Module designation	**Fish biology**
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	*Elective component.* Biology and ecology of animals
Teaching methods	Lecture, Seminar, Laboratory work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *4 hours per week for Laboratory work, total 30 Contact hours.* *180 self-study hours*
Person responsible for the module	***Sharakhmetov Sayat Ermukhanbetovich*** Senior lecturer of the Department of Biodiversity and bioresources, PhD
Language	Kazakh / Russian
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plant. Cell Biology and histology. Environmental ethics and the impact of physical fields on a living organism.

Discipline objectives: /intended learning outcomes	**Discipline objectives**: to form the apply knowledge about the external morphological features and structural features of the internal organs of various fish species. **Learning outcomes:** - to know the functions of the respiratory, circulatory, genitourinary and nervous systems of fish; - to study fish communities and biotic relationships and the influence of abiotic factors; -to know the modern taxonomic status, phylogeny and geographic distribution of the studied fish species; -to determine the species of fish and their diversity with the help of literature; -to possess the methods of biological and morphological analysis of fish and statistical processing of results. -this knowledge can be used in the future to solve various scientific problems, practical problems of fisheries, teaching activities in educational institutions, in planning and conducting environmental measures.
Content	Introduction to fish biology. The subject of fish biology, goals and objectives. Methods of studying biology, ecology and adaptation of fish to various conditions. Features of the external structure of fish and fish-like. Features of the internal structure of fish and fish-like animals as aquatic animals. The skeleton and muscular system of fish. The structure and functions of the respiratory and circulatory systems of various fish species. The structure and functions of the genitourinary and water and salt exchange of various fish species. The structure and functions of the digestive and nervous systems of various fish species. Fundamentals of general ichthyology. Basic principles of zoological systematics. Species and intraspecific structure in fish. Fish communities and biotic relationships and the influence of abiotic factors. Molecular genetic studies, phylogeny, and geographical distribution of the studied fish species. Private ichthyology. Comparative characteristics of the structure of the main taxonomic groups of fishes. Determination of the species belonging of representatives of the main orders of bony fish. Methods of biological and morphological analysis of fish and statistical processing of the results. Problems of conservation of fish-like and fish. The main ways to save them.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions

Reading list	1. Baymbet, A.A. Fundamentals of Ichthyology. - Almaty, 2005. - 84 p. 2. Anisimova I.M., Lavrovsky V.V. Ichthyology. M., 1983. 255 p. 3. Ponomarev S.V., Bakaneva Yu.M., Fedorov Yu.V. Ichthyology. –Saint Petersburg-Moscow-Krasnodar: Lan, 2020. -560 p. 4. Nelson, Joseph S. Fishes of the world fauna.- M., 2009. - 880 p. 5. Bone Q., Moore R. Biology of fishes. – Taylor & Francis, 2008.

Module designation	Biology and ecology of mammals
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	*Elective component.* Vertebrate Zoology and higher plants
Teaching methods	Lecture, Laboratory work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *4 hours per week for Laboratory work, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	**Sapargalyieva Nazym** *Senior lecturer Department of Biodiversity and bioresources, Candidate of Biological Science*
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	Vertebrate Zoology and higher plants. Cell Biology and histology. Human and animal physiology. Microscopic technique and human and animal anatomy.
Discipline objectives /intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the meeting species of mammals on the territory of Kazakhstan and determine them in natural conditions. **Learning outcomes:** - know the taxonomy, morphological and physiological features of mammals; - be able to determine orders, families, genera and species of mammals by skulls, skins, carcasses and stuffed animals; - know the methods of carrying out accounting works for individual groups of mammals; - be able to use mammalian research methods in practical work and experimental research; - to know and analyze the scientific basis of management of populations of important mammal species; - use the obtained theoretical and practical knowledge in research works and their professional activities and be able to assess their results.

Content	Introduction. Modern Directions and methods of theriological research. The origin and evolution of mammals. A systematic review of the class of mammals. Morphology of mammals. Diversity of mammalian biological types in their exploration of the natural environment. Nutrition of mammals. Activity of mammals. Concept of population, structure and dynamics of mammal populations. Production mammals. Rare and endangered species mammals.
Examination forms	Test in the "Univer" platform: 300 questions base, the test form includes single (1 of 5) and multi-choice (2 or 3 of 8) options; exam - 90 minutes for 40 questions.
Reading list	1. Yeszhanov B.E., Berkinbay O., Nurgazy K. General theriology. - Almaty. - 2010. - 385 p.(Education book in kazakh). 2. Yeszhanov B.E., Sapargaliyeva N.S. Vertebrate zoology. - T. 2. - Almaty: Kazakh university. - 2014. - 356 p. (Education book in kazakh). 3. Sapargaliyeva Nazym. A laboratory manual of vertebrate zoology. Educational-methodical manual. Almaty: Kazakh university. - 2022. - 144 p. 4. Olzhabekova K.B., Yeszhanov B.E. Vertebrate zoology. - Almaty. - 2007. - 400 p. (Education book in kazakh). 5. Bone Q., Moore R. Biology of fishes. – Taylor & Francis, 2008.

Module designation	**Biology and ecology of insects**
Credit points	6
Semester(s) in which the module is taught	7
Relation to curriculum	Elective component Zoology of invertebrates and lower plant.
Teaching methods	Lecture, Laboratory work.
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact hours.* *120 self-study hours*
Person responsible for the module	**Shalgimbayeva Saule Mukhametkalievna** *Senior Lecturer, Department of Biodiversity and Bioresources. Candidate of Biological Science*
Language	*Kazakh / Russian*
Required and recommended prerequisites for joining the module	Zoology of invertebrates and lower plant.

Discipline objectives /intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the diversity of insects of the native land, the features of their ecology. **Learning outcomes:** - have a complex of knowledge about invertebrates, their role in ecosystems; - be able to apply them in their practical activities; - to know the morphofunctional organization of representatives; - be able to work with living organisms and their communities in nature and laboratory conditions; - to know conditions with the skills of zoological research, - be able to conduct research and environmental protection activities for animals, peace of the native land; - be able to apply their knowledge of entomology in their future professional activities activity;
Content	Introduction Biology and ecology of insects. Fundamentals of entomology. Subject, tasks and a brief outline of the history of general entomology. The structure of the head, chest and types of legs of insects. The structure of the wings and their types. Skin and muscular system of insects. Digestive, circulatory and respiratory systems.Nervous system, sense organs. Reproductive system and reproduction. Development, life cycle and diapause. Systematics and classification of insects. Primary wingless insects: main orders. Higher or winged insects: main orders.Ecology of insects: introductory concepts. Action of abiotic factors. Biotic factors. The role of insects in nature and for humans.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Kalieva A.B., Ospanova A.K., Bitkeeva A.A. Medical entomology. Tutorial. - Pavlodar, 2014. 74 p. 2. Parasitology and invasive diseases farm animals. Ed. prof. N.T. Kadyrov. Astana, 2012. - 555 p. 3. Dauitbaeva K.A. Omyrtqasyzdar zoology. 1- big. Almaty, 2004. 10-48s 4. Dauitbaeva K.A. Omyrtqasyzdar zoology. 2- big. Almaty, 2005. 56-105 p. 5.Dauitbaeva K.A., Shalgymbaeva S.M. Zoology. I-bolim. Omyrtqasyzdar zoology. Almaty, 2013. 55-72 p. 6. Satybaldieva G.K., Ormanova G.Zh., Baimurzaev N.B. "Omyrtkasyzdar zoology" workshop. Oku kuraly. Kazakh University, 2020. 103-122 p. 7. Esenbekova P.A., Dautbaeva K.A., Ormanova G.Zh. Dala-oku praktikasyna arnalgan oku kuraly. Kazakh University, 2013. 20-28 p.

M-13 Human and plant genetics

Module Objectives. Students will be able to: 1 explain the genetic and molecular bases of infectious diseases of plants caused by fungi, bacteria and viruses, as well as under the influence of environmental factors; 2 identify sources of plant resistance to phytopathogens; 3 explain the molecular, biochemical and cytological basis of genetic diseases; 4 classify the forms of hereditary pathology; 5 calculate the level of influence of the environment on the manifestations of hereditary traits; 6 use apply methods of cytological evaluation of meiosis in aneuploidids; 7 classify chromosomes in the chromosome set of a person; 8 classify quantitative and structural aberrations of chromosomes; analyze metaphase chromosomes of plants, animals and humans;

Discipline designation	Phytopathology
Credit points	9
Semester(s) in which the discipline is taught	7
Relation to curriculum	*Elective component* Genetics. Molecular Biology.
Teaching methods	Lecture, Seminar, Laboratory work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Seminar, total 30 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact hours.* *180 self-study hours*
Person responsible for the discipline	***Zhunusbayeva Zhazira Kabulovna*** Acting Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science ***Omirbekova Nargul Zhapparovna*** Professor of Department Molecular Biology and Genetics, Doktor of Biological Science ***Zhussupova Aizhan Izbasarovna*** Senior Lecturer of Department of Molecular Bilogy and Genetics, PhD
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the discipline	Genetics. Molecular biology
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to describe the types and mechanisms of plant immunity and evaluate the factors affecting the susceptibility and resistance of plants to pathogens. **Learning outcomes:** - reveal the genetic and molecular bases of infectious diseases of plants caused by fungi, bacteria and viruses, as well as under the influence of environmental factors; - evaluate the genetic collection of cultivated plants for resistance to phytopathogens;

	- investigate genomic polymorphism in phytopathogenic microorganisms; - identify sources of plant resistance to phytopathogens; - simulate methods for analyzing the genetic diversity of microorganisms on cultivated plants.
Content	Genetic and molecular bases of infectious plant diseases caused by fungi, bacteria and viruses. Genetic and molecular bases of infectious plant diseases growing in various environmental and climatic conditions and exposed to various environmental factors. Genomic polymorphism of phytopathogenic microorganisms. Modeling methods for analyzing the genetic diversity of microorganisms. Methods for assessing the genetic collection of cultivated plants for resistance to phytopathogens.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. Beloshapkina O.O. Phytopathology: textbook. M.: INFRA-M, 2018. - 288 p. (In Russian) 2. Karbozova R.D., Tulengutova K.N. Phytopathology. - Almaty : Dauir, 2014. - 312 p. (In Kazakh) 3. Fedorov N.I., Yarmolovich V.A. Forest phytopathology. Laboratory workshop: studies. - Mn.: BSTU, 2005. - 448 p. (In Russian) 4. Semenkova I.G., Sokolova E.S. Phytopathology: textbook for students. universities. - M.: Publishing Center Academy, 2003. - 480 p. (In Russian) 5. Dyakov Yu.T., Elansky S.N. General phytopathology. - Lomonosov Moscow State University. 2018. -230 p. (In Russian) 6. Dyakov Yu.T., Ozeretskovskaya O.L., Javakhia V.G., Bagirova S. General and molecular phytopathology book. - M., 2020. - 300 p. (In Russian)

Discipline designation	**Human genetics**
Credit points	9
Semester(s) in which the module is taught	7
Relation to curriculum	*Elective component* Human and plant genetics.
Teaching methods	Lecture, Practical work, Laboratory work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours;* *2 hour per week for Seminar, total 30 Contact hours;* *2 hour per week for Laboratory, total 30 Contact hours.* *180 self-study hours*
Person responsible for the discipline	***Kalimagambetov Aitkali Mazhitovich,*** Senior Lecturer of Department of Molecular Bilogy and Genetics, Candidate of Biological Sciences ***Lovinskaya Anna Vladimirovna,***

	Senior Lecturer of Department of Molecular Bilogy and Genetics, PhD,
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the discipline	Human Biochemistry, Molecular Biology, Human Anatomy, Histology and Cytology.
Discipline objectives/intended learning outcomes	**Discipline objectives:** to form the ability to analyze the role of hereditary factors in the occurrence of hereditary pathologies in humans **Learning outcomes:** - understand the applied value of medical genetics and demonstrate its modern achievements; - explain the mechanisms of the occurrence of hereditary diseases; - apply genetic methods in the field of medicine; - describe the clinic and genetics of hereditary diseases; - systematize the problems of prevention and the principles of modern treatment of hereditary diseases.
Content	Brief history of the development of medical genetics. Modern advances in medical genetics in the diagnosis, treatment and prevention of hereditary diseases.Molecular, biochemical and cytological basis of genetic diseases. Laws of inheritance of traits. Features of the quantitative and qualitative manifestation of genes in traits. The main provisions of the chromosome theory of heredity.The concept of human hereditary diseases. Classification of forms of hereditary pathology. Population genetics. Mechanisms of gene balance in populations. Mutation process as a factor of gene imbalance in populations. Chromosomal diseases. Principles of clinical cytogenetics. Frequency and types of chromosomal disorders in human ontogenesis. Chromosomal diseases caused by abnormalities of autosomes and sex chromosomes. Clinic and cytogenetics of chromosomal syndromes. The concept of multifactorial (polygenic) diseases, their features, diagnosis and prevention. Hereditary pathological reactions to the action of external factors. Pharmacogenetics. Ecogenetics. Environmental pollution.Diagnosis of hereditary pathology. Basic genetic methods in the diagnosis of hereditary pathology. Method of mass (sifting) diagnostics. Diagnosis of heterozygosity.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1.Lynn B. Jorde, John C. Carey, Michael J. Bamshad. Medical Genetics. - 6th Edition – 2019. - 300 p. 2. Robert L. Nussbaum, Roderick R. McInnes, Huntington F Willard. Thompson & Thompson Genetics in Medicine. - - Elsevier, 2019. - 500 p. 3. Yurov I.Yu., Voinova V.Yu., Vorsanova S.G., Yurov Yu.B. Molecular and clinical bases of hereditary diseases. - M.: Academy of Natural Sciences, 2018. - 100 p. (In Russian)

	4. Lewis R. ISE Human Genetics Paperback. - McGraw-Hill, 2020. – 562 p. 5. Lewis R. Human Genetics: The Basics. - Garland Science; 2nd edition, 2016. – 192 p.

Discipline designation	Cytogenetics
Credit points	6
Semester(s) in which the discipline is taught	7
Relation to curriculum	*Elective component* Human and plant genetics
Teaching methods	Lecture, Seminar, Laboratory work
Workload (incl. contact hours, self-study hours)	*15 weeks,* *1 hour per week for Lecture, total 15 Contact hours.* *1 hour per week for Seminar, total 15 Contact hours* *2 hours per week for Laboratory work, total 30 Contact hours* *120 self-study hours*
Person responsible for the discipline	***Kalimagambetov Aitkali Mazhitovich*** Senior Lecturer of Department Molecular Biology and Genetics, Candidate of Biological Science, ***Kolumbayeva Saule Zhanabayevna*** Professor of Department Molecular Biology and Genetics. Doctor of Biological Science ***Chunetova Zhanar Zhumabekovna*** Associate Professor of Department Molecular Biology and Genetics, Candidate of Biological Science ***Lovinskaya Anna Vladimirovna*** Senior Lecturer of Department Molecular Biology and Genetics, PhD
Language	Kazakh, Russian, English
Required and recommended prerequisites for joining the discipline	Cytology, Histology and embryology, Genetics
Discipline objectives/ intended learning outcomes	**Discipline objectives**: to form the ability to use modern cytogenetic methods to classify and analyze interphase and metaphase chromosomes. **Learning outcomes***:* - demonstrate knowledge of the structural and functional organization of chromosomes; - explain the genetic mechanisms (mitosis, meiosis), which determine the continuity of hereditary properties; - analyze genetic changes in the chromosomal set (gene, chromosomal, genomic mutations) and their causes; - conduct cytogenetic analysis, - practice cytogenetic methods in accordance with the objectives of the study.
Content	Chromosomal theory of heredity. The basic principles and methods of modern cytogenetics. Features of the structural and functional organization of human chromosomes. The distribution of

	chromosomes in mitosis, meiosis and fertilization. Concept of karyotype, principles of karyotyping. Methods for the production and identification of polyploid forms. Fertility and viability of pollen and methods for their assessment. Cytological assessment of mitosis and meiosis in plants. Types of structural disorders of chromosomes. Metaphase analysis of chromosome aberration. DNA comet assay. Analysis of reciprocal translocations in spermatocytes and other cytogenetic methods. Cytological basis and mechanisms of chromosomal disease. Clinic and cytogenetics of chromosomal syndromes. Mutagenic factors as the cause of chromosomal aberrations. Cytogenetic methods for diagnosing chromosomal pathology. Clinic and cytogenetics of chromosomal diseases, their classification. The principles of analysis of X-chromatin and human karyotype in health and disease.
Examination forms	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Reading list	1. The Principles of Clinical Cytogenetics // Edited by S.L. Gersen, M.B. Keagle. - Humana Press Inc, 2015 2. Kolumbayeva S.Zh., Lovinskaya A.V., Kalimagambetov A.M. Cytogenetic methods in genetic monitoring. Almaty: Qazaq University, 2021. – 165 p. (In Kazakh) 3. Abilev S.K., Glazer V.M. Mutagenesis with the basics of genotoxicology. - M.-SPb: Nestor-History, 2015 (In Russian) 4. Yurov I.Yu., Voinova V.Yu., Vorsanova S.G., Yurov Yu.B. Molecular and clinical bases of hereditary diseases. - M.: Academy of Natural Sciences, 2018. - 100 p. (In Russian) 5. Pukhalsky, V.A., Cytology and cytogenetics of plants / V.A. Pukhalsky, A.A. Solovyov, V.N. Yurtsev. M.: Publishing House of the Moscow Agricultural Academy, 2004. - 278 p. (In Russian) 6. Shulembayeva K.K., Chunetova Zh.Zh., Tokubaeva A.A. Plant cytogenetics: tutorial. - Almaty: Qazaq University, 2017. - 153 p. (In Kazakh)

M-13 Physiology and biophysics of living systems

Module Objectives. Students will be able to:

- interpret their ideas about the fundamental principles and levels of biological organization, regulatory mechanisms at each level, based on the role of biological diversity as a leading factor in the sustainability of living systems and the biosphere as a whole;
- understand and apply the first and second laws of thermodynamics; Hess's law, principles of Prigogine and E. Bauer, principles of formation and functioning of supraorganismal systems;
- know the biochemical characteristics of the main subcellular components, metabolic pathways and the molecular basis of intracellular processes and physiological processes;
- be able to use regulatory mechanisms to ensure the homeostasis of living systems, including ideas about the formation of immunity;
- analyze the concept of stability and instability in the existence of organisms and superorganismal systems, about the mechanisms of the relationship between the organism and the environment;
- be able to conduct and substantiate the grounds for physiological or environmental expertise, methods of analysis and modeling of environmental processes;
- understand and explain the life processes of the animal organism in their unity and relationship with the environment; general patterns and specific features of the activity of various body systems and their individual structural elements;
- apply in practice various experimental methods for studying the physiological functions of the body, evaluate the functional states of physiological systems and the whole organism, interpreting the results of the study;

Module designation	***Physiological and biophysical mechanisms of adaptation and kinetics of drugs***
Credit points	9
Semester(s) in which the discipline is taught	7
Relationship to curriculum	*Elective component.* Physiology and biophysics of living systems.
Teaching methods	Lecture, Laboratory works
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	***Murzakhmetova Maira Murzakhmetovna,*** Doctor of Biological Science, Professor of Department of Department of Biophysics, Biomedicine and Neuroscience. ***Bahtybaeva Layla Kirgizbaevna,*** Candidate of Biological Sciences, Associate Professor of the Department of Biophysics, Biomedicine and Neuroscience. ***Akhmetova Aigul Bazylbekovna,*** Candidate of Biological Sciences of the Department of Biophysics, Biomedicine and Neuroscience.
Language	Kazakh / Russian / English
Required and recommended prerequisites for learning the module	Growth physiology and endocrinology. Special practical work on physiological and biophysical methods of research.

Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the patterns of life and adaptive features of the body and its parts in unity with the relationship with the environment, features and patterns of adaptation, as well as the ability to analyze the main pharmacodynamic and pharmacokinetic mechanisms of action of drugs and methods for regulating the physiological activity of various body systems with the help of drugs drugs. **Learning outcomes:** - have an idea and understanding of the laws of life and adaptive features of the body -know the characteristics of the organism and its parts in the unity of the relationship with the environment, features and patterns of adaptation; - analyze the main pharmacodynamic and pharmacokinetic mechanisms of drug action - evaluate the latest achievements in the physiology of adaptation and the prospects for their use in various fields of practice and medicine; - use knowledge on the methods of regulation of the physiological activity of various body systems with the help of drugs in solving theoretical, practical issues and performing research work to explain the most important biological processes, apply adequate research methods in experimental biology.
Content	When studying the discipline, students will study the following aspects: patterns of life and adaptive features of the organism and its constituent parts in their unity and relationship with the environment. Adaptation of the body to the conditions - the environment. Adaptation of the body to muscle work. Physiological and biochemical mechanisms of urgent and long-term adaptation. Training effect. Improving the existing physiological mechanisms of regulation. Kinetics of drugs.
Exam form	Standard Written Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam – 2 hours for 2-3 questions
Bibliography	1. Myshkin, I. Yu. state un-t im. P. G. Demidov. - Yaroslavl: YarGU, 2016. - 48 p. 2. Fundamentals of cell biology: textbook / N.G. Paleev, I.I. Beschetnov. - Rostov-on-Don: Publishing House of the Southern Federal University, 2011. - 246 p. ISBN 978-5-9275-0821-1 3. Mironova I.K., Kanevsky M.V. A short course of lectures on biophysics. Saratov 2017 4. Svishchev G.M. - Confocal microscopy and ultramicroscopy of a living cell - Fizmatlit Publishing House - 2011 - 120s. - ISBN: 978-5-9221-1320-5 5. Milaeva E.R. Bioinorganic chemistry. Moscow State University, 2020.

Module designation	Growth physiology and endocrinology

Credit points	9
Semester(s) in which the discipline is taught	7
Relationship to curriculum	*Elective component.* Physiological and biophysical mechanisms of adaptation and kinetics of drugs
Teaching methods	Lecture, Laboratory works
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 60 Contact hours.* *180 self-study hours*
Person responsible for the module	***Srailova Gulziya Turapovna*** Candidate of Biological Sciences, Associate Professor of the Department of Biophysics, Biomedicine and Neuroscience. *Zhaparkulova Nazgul Ikhsanovna* Candidate of Biological Sciences, Associate Professor of the Department of Biophysics, Biomedicine and Neuroscience.
Language	Kazakh / Russian / English
Required and recommended prerequisites for learning the module	Special practical work on physiological and biophysical methods of research.
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the physiology of a developing organism, the patterns of growth and development, the assessment of the health of children and adolescents, the features of the formation and development of all body systems, the formation of a holistic systemic view of endocrinology, allowing to assess the state of the endocrine system of the body, to substantiate the features of hormonal regulation of physiological systems organism and its reserve capabilities. **Learning outcomes:** - Systematize knowledge about the functions of glands of internal secretion; produced by them products (hormones), on the ways of their formation and action on the organism of animals and humans - Explain and systematize the general patterns and specific features of the endocrine system, their individual structural elements and the organism as a whole - To apply and analyze knowledge on endocrinology in practical and scientific research activities; have the skills to conduct research in the field of endocrinology. - Analyze, compare, link and draw conclusions about the mechanisms of hormones, hormonal regulation, the functional reserves of the organism and its interaction with the environment. - Conduct studies on the effect of hormones in the body and their role in regulation. - use the knowledge of the physiology of a developing organism and endocrinology in solving theoretical and practical issues and performing research work to explain the most important biological processes, apply adequate methods in experimental biology.
Content	When studying the discipline, students will study the following problems of the theoretical and methodological foundations of

	age-related anatomy and physiology, patterns of growth and development of children and adolescents, mechanisms that ensure the interaction of individual parts of the body and the body as a whole with the external environment depending on external influences, general patterns of growth and development children and adolescents, criteria for assessing the health of children and adolescents, features of the formation and development of all body systems, provides a theoretical basis for organizing a scientifically based educational process that is adequate to the physiological capabilities of the body in different age periods.
Examination forms	Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	1. Agadzhanyan N.A., Tel L.Z., Tsirkin V.I. Human physiology. - M., Novgorod: publishing house of NGMA, 2010. 2. Normal physiology / Agadzhanyan N.A., Smirnov V.M. - 3rd edition. - M .: Academy, 2010. 3. Human and animal physiology: a textbook for universities / ed.: Apchel V.Ya., Darinsky Yu.A., - M .: Academy, 2011 4. Markeeva S.S., Srailova G.T., Askarova Z.A. Guide to laboratory studies in human and animal physiology: Textbook. Almaty, 2012 5. Solodkov A.S., Sologub E.B. Human physiology. General. Sports. Age: textbook. - 4th edition: M.: Sov.sport, 2020.

Module designation	**Special practical work on physiological and biophysical methods of research**
Credit points	6
Semester(s) in which the discipline is taught	7
Relationship to curriculum	*Elective component.* Physiological and biophysical mechanisms of adaptation and kinetics of drugs
Teaching methods	Lecture, Laboratory works
Workload (incl. contact hours, self-study hours)	*15 weeks,* *2 hour per week for Lecture, total 30 Contact hours.* *2 hours per week for Laboratory work, total 30 Contact hours.* *120 self-study hours*
Person responsible for the module	***Kulbaeva Marzhan Susarovna*** Senior lecturer of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences, ***Shapovalov Yuriy Aleksandrovich*** Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences ***Shvetsova Yelena Vitalyevna*** Senior lecturer of the Department of Biophysics, Biomedicine and Neuroscience, Candidate of Biological Sciences

Language	Kazakh, Russian, English
Required and recommended prerequisites for learning the module	Growth physiology and endocrinology
Discipline objectives/intended learning outcomes	**Discipline objectives**: to form the ability to apply knowledge about the rational use of modern high-tech equipment in students when conducting research in scientific laboratories in preparing students for professional activities in scientific institutions, in clinical diagnostic and treatment and prevention laboratories. Will be studied: modern photometric and spectral research methods, polarographic, conductometric and electrophysiological methods. **Learning outcomes:** - to form a systemic understanding and understanding of the foundations of modern methods of biophysical research, which are the necessary basis for conducting research work, with subsequent scientific, industrial, pedagogical activities. - solve specific problems in choosing the most promising method of analysis and competently select the equipment necessary for conducting research. - correctly evaluate the reliability of the results obtained using metrological characteristics (interval of permissible errors, correctness, reproducibility, convergence), as well as analytical (sensitivity coefficient, selectivity, duration, performance). - to evaluate the significance of the results obtained in their own professional development and in the development of scientific ideas about the role of modern methods of biophysical research in medical and preventive and scientific institutions. - apply the scientific knowledge of modern biophysical research methods in practical professional activities in clinical diagnostic laboratories, medical and preventive and scientific institutions.
Content	When studying the discipline, students will study the following aspects: modern photometric and spectral research methods, polarographic, conductometric and electrophysiological methods, as well as sample preparation methods for analytical studies and types of auxiliary equipment used for research.
Examination forms	Standard Oral Exam: Base question amount 10-30: questions on the application of knowledge regardless of the number of students, regardless of loans for any level of education; exam –2-3 questions, time of preparation for the answer – 10-20 minutes
Reading list	1. Agadzhanyan N.A. Normal physiology: N.A. Agadzhanyan, V.M. Smirnov - 3rd ed., corrected. And extra. - LLC "Publishing House "Medical Information Agency" - 2012. - 576p. 2. Kostyuk, V. A. Fundamentals of cellular physiology: a guide / V. A. Kostyuk. - Minsk: BGU, 2016. - 143 p. 1. Zupanets I.A. Clinical laboratory diagnostics: research methods 3rd ed., Revised. and additional Kharkiv: NUPh Publishing House: Golden Pages, 2005. P.200. 2. Myrzakozha D.A., Mirzakhozhaev A.A. Modern research methods. Ed. Krisanalit, Almaty, 2006, p.303.

	3. Kishkun A.A. Guide to laboratory diagnostic methods Publisher: GEOTAR-Media, 2007 P.822.1. Kolman Ya., Rem K.-G. Visual biochemistry. Per. with him. 2004. 2. Boldyrev A.A. Biomembranology / A.A. Boldyrev, E.I. Kyavaryaynen, V.A. Ilyukha // M.: Ed. Moscow State University, 2006. 3. Biological membranes. Methods /Ed. J.B. Findlay, W.G. Evanza// M.: Mir, 1990.

FINAL ATTESTATION

Module designation	**FINAL ATTESTATION**
Credit points	12
Semester(s) in which the module is taught	8
Relation to curriculum	Additional types of training Elective
Teaching methods	Protection of the diploma work
Workload (incl. contact hours, self-study hours)	**360 hour**
Person responsible for the module	Members of the attestation commission
Language	Kazakh / Russian / English
Required and recommended prerequisites for joining the module	Discipline in speciality, Professional (Training) practices, Professional (pre-diploma) practice
Module objectives/intended learning outcomes	Aim of Writing and Presentation of Diploma Work (Project): to form the ability of graduate students to demonstrate the skills of conducting research work based on theoretical knowledge and experimental methods; to generalize the knowledge gained in the speciality; to develop and justify proposals for solving the tasks on the topic of the thesis and publicly defend their point of view. Learning outcomes: 1 systematize theoretical and practical knowledge in the field of biology; 2 justify the chosen methods and methods of research; 3 research the approved topic of the diploma work; 4 write and format diploma work following the requirements; 5 demonstrate the application of acquired knowledge and skills in preparing, writing and presenting diploma work A student who has passed the final certification and confirmed the mastery of the educational programmes of higher education is awarded a bachelor's degree by the decision of the attestation commission or is awarded a qualification in the relevant educational programmes and is issued a diploma with an appendix free of charge. The diploma appendix (transcript) indicates the latest grades according to the point-rating letter system of assessments for all academic disciplines, completed term papers (projects), research or experimental research work, types of professional practices, and final certification, indicating their volume in academic credits and hours. In addition to the diploma, graduates of undergraduate educational programmes are issued a

	European Diploma Supplement (Diploma Supplement) free of charge.
Content	Diploma works
Examination forms	Defence of the diplom work