

**APPROVED**  
**at a meeting of the**  
**Scientific Council**  
**NJSC «Al-Farabi KazNU».**  
**Minutes No.10 dated**  
**May 23, 2022.**

**The program of the entrance exam for applicants to the PhD**  
**for the group of educational programs**  
**D087 – «Environmental protection technologies»**

**1. General provisions.**

1. The program was drawn up in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 600 “On Approval of the Model Rules for Admission to Education in Educational Organizations Implementing Educational Programs of Higher and Postgraduate Education” (hereinafter referred to as the Model Rules).

2. The entrance exam for doctoral studies consists of writing an essay, passing a test for readiness for doctoral studies (hereinafter referred to as TRDS), an exam in the profile of a group of educational programs and an interview.

<b>Block</b>	<b>Points</b>
1. Essay	10
2. Test for readiness for doctoral studies	30
3. Exam according to the profile of the group of the educational program	40
4. Interview	20
Total admission score	100/75

3. The duration of the entrance exam is 4 hours, during which the applicant writes an essay, passes a test for readiness for doctoral studies, and answers an electronic examination. The interview is conducted on the basis of the university separately.

**2. Procedure for the entrance examination.**

1. Applicants for doctoral studies in the group of educational programs D087 – «Environmental protection technologies» write a problematic / thematic essay. The volume of the essay is at least 250-300 words.

2. The electronic examination card consists of 3 questions.

## **Topics for exam preparation according to the profile of the group of the educational program.**

### **Discipline «Ecology and sustainable development»**

#### **Topic 1. Autecology – ecology of individuals**

**Sub-topics.** Organisms and their habitat. Environmental factors. Regularities of the action of environmental factors on organisms. Liebig's Law of the minimum. Shelford's Law of Tolerance. Adaptation to natural phenomena.

#### **Topic 2. Demecology – population ecology**

**Sub-topics.** Population – a structural unit of a species, a unit of evolution. Populations classification. Quantitative indicators of populations. Static population indicators. The effect of environmental factors on populations.

#### **Topic 3. Biogeocenology (Ecosystem and its environment)**

**Sub-topics.** Types of ecosystems, structure of biogeocenoses. Ecological borrowing in the ecosystem. Power supply circuits. Energy in ecosystems. The law of the energy pyramids. Ecological pyramids.

#### **Topic 4. The biosphere and the biosphere-noosphere concept of V.Vernadsky and biogeochemical cycles**

**Sub-topics 1.** Evolution of the biosphere. V.Vernadsky's biosphere-noosphere concept. Functions of living matter. Properties of living matter. Basic properties of the biosphere.

**Sub-topics 2.** Characteristics of cycles. The water cycle. The carbon cycle. The oxygen cycle. The nitrogen cycle. The phosphorus cycle. The sulfur cycle. The xenobiotic cycle. Anthropogenic cycles and its impact on the biosphere

#### **Topic 5. Problems of civilization and global environmental problems. Global pollution of biosphere components**

**Sub-topics.** Problems of civilization. Global environmental problems. Energy problems. Demographic problem. The food problem. Global pollution. Types of biosphere pollution. Global pollution of the hydrosphere, atmosphere, and lithosphere.

#### **Topic 6. Natural resource potential**

**Sub-topics.** Natural resources. Classification. Nature management. Problems of using natural resources.

#### **Topic 7. Protection of water resources. Soil protection and its rational use**

**Sub-topics.** Sources of surface and underground water pollution. Wastewater treatment: Mechanical treatment. Physical and chemical cleaning. Chemical methods. Biological treatment. Rational use of water resources in Kazakhstan. Ecological state of the soils of Kazakhstan. Land reclamation. Sources and causes of pollution and depletion of land resources.

#### **Topic 8. Environmental control and monitoring of the environment and natural resources**

**Sub-topics.** Environmental control. Monitoring. The structure of the monitoring system. Unified state system for monitoring the environment and natural resources.

#### **Topic 9. Sustainable development**

**Sub-topics.** Concepts and global models of the future world. Sustainable development in the Republic of Kazakhstan. International cooperation in the field of environmental protection. Specially protected areas of Kaazakhstan.

Discipline «**Geocology**»

**Topic 1. Geocology: the system of sciences on integration of the geospheres and society**

Sub-topic 1. The interrelations of the ecosphere and the society

Sub-topic 2. Systemic features of the geocological problems

**Topic 2. Natural factors of the ecosphere**

Sub-topic 1. Energy and matter features of the ecosphere

Sub-topic 2. The energy balance of the ecosphere

Sub-topic 3. The role of the biota in the ecosphere's functioning

**Topic 3. Socio-economic factors of the ecosphere**

Sub-topic 1. Main groups of factors for the ecosphere's state

Sub-topic 2. World population as a geocological factor

Sub-topic 3. Consumption of natural resources and geocological "services"

Sub-topic 4. Geocological role of thr technological progress

**Topic 4. Global changes and strategies of humanity**

Sub-topic 1. Potential capacity of the territory

Sub-topic 2. Elements of a strategy for the survival of humanity

Sub-topic 3. Indicators of geocological status and sustainable development

**Topic 5. Impact on the Earth's atmosphere and climate**

Sub-topic 1. Main features of the Earth's atmosphere and climate

Sub-topic 2. Ozone layer degradation

Sub-topic 3. Ecosphere acidification and acid precipitation

Sub-topic 4. Local air pollution

**Topic 6. The impact of human activity on the hydrosphere**

Sub-topic 1. Main features of the hydrosphere

Sub-topic 2. The main functions of land waters in the ecosphere

Sub-topic 3. Geocological issues of the water management

Sub-topic 4. Geocological features of the drainless regions of the world

Sub-topic 5. Land water quality, fresh water scarcity and degradation

Sub-topic 6. Geocological problems of sea coasts and inland seas

**Topic 7. Geocological problems of the use of soil and land resources**

Sub-topic 1. Main functions of the pedosphere

Sub-topic 2. Anthropogenic soil degradation

Sub-topic 3. The land resources of the world and their use

Sub-topic 4. Geocological problems of agriculture

**Topic 8. The impact of human activity on the lithosphere**

Sub-topic 1. The structure of the Earth and the lithosphere

Sub-topic 2. The great cycle of matter and the role of man in it

Sub-topic 3. Anthropogenic impacts on adverse exogenous processes

**Topic 9. The impact of human activity on the biosphere and landscapes of the world**

Sub-topic 1. Main features of the biosphere and its role in the ecosphere

- Sub-topic 2. Biotic management of the ecosphere and the role of human activity
- Sub-topic 3. Problems of deforestation
- Sub-topic 4. Problems of desertification
- Sub-topic 5. Problems of preserving the Earth's biological diversity

### **Topic 10. Geocological aspects of natural and technogenic systems**

- Sub-topic 1. Natural and technogenic systems
- Sub-topic 2. Geocological issues of urbanization
- Sub-topic 3. Geocological issues of energy
- Sub-topic 4. Geocological issues of industry
- Sub-topic 5. Geocological issues of transport
- Sub-topic 6. Geocological issues of agriculture

### **3. List of references.**

#### **Main:**

1. Bazarbayeva T.A., Ramazanova N.E. Geocology. Textbook. Almaty, 2020.
2. Бигалиев А.Б. Общая экология. Учебное пособие. Алматы: Изд-во «NURPRESS», 2011. – 162 с.
3. Нуркеев С.С., Мусина У.Ш. Экология: Учебное пособие для технических вузов. – Алматы: МОиН РК, 2005. – 490 с.
4. Аубакирова К.Д., Базарбаева Т.А., Таныбаева А.К. Экология и устойчивое развитие: учеб.-метод. пособие. - Алматы: Қазақ ун-ті, 2015. – 260 с.
5. Колумбаева С.Ж. Экология и устойчивое развитие: учеб. пособие. - Алматы: Қазақ ун-ті, 2011. – 153 с.
6. Голубев Г.Н. Основы геоэкологии. Учебник. М.:ЛитагентКнорусс, 2013. – 416 с.
7. Оспанова Г.С., Бозшатаева Г.Т. Экология. А.: Экономика, 2002.
8. Бродский А.К. Экология: учебник. М.: КНОРУС, 2012.
9. Комарова Н.Г. Геоэкология и природопользование: учеб. пособие. М.: Академия, 2007
10. Прохоров Б.Б. Социальная экология: учебник для вузов. М.: Академия, 2007.
11. Тетиор А.Н. Городская экология: учеб. пособие. М.: Академия, 2007.
12. Трифонова Т.А., Селиванова Н.В., Мищенко Н.В. Прикладная экология: учеб. пособие. М.: Гаудеамус, 2007.

#### **Additional:**

1. Акимова Т.А., Кузьмин А.П., Хаскин В.В. Экология: природа – человек – техника: учебник для вузов. М.: Экономика, 2007.
2. Акимова Т.А., Хаскин В.В. Экология: человек – экономика – биота – среда: учебник для вузов. М.: ЮНИТИ, 2007.
3. Ветошкин А.Г. Теоретические основы защиты окружающей среды: учеб. пособие. М.: Высшая школа, 2008.
4. Рудский В.В., Стурман В.И. Основы природопользования: учеб. пособие. М.: Аспект Пресс, 2007.
5. Передельский Л.В. Экология и охрана окружающей среды: учебник. М.: КНОРУС, 2013.
6. Экология. Геоэкология недропользования: Учебник для вузов / Милютин А.Г., ред. М.: Высшая школа, 2007.

## Discipline «**Hazardous natural processes**»

### **Topic 1. Modern processes of relief formation and their classification.**

Sub-topics: Classifications of relief formation processes. Cascade and paragenesis of the development of natural processes.

### **Topic 2. Modern natural hazardous processes.**

Sub-topics: Droughts and their environmental impacts; Desertification and its ecological consequences; Erosion processes and their ecological consequences; Karst process and its ecological consequences; Glacier activity and its ecological significance;

### **Topic 3. Untidy natural processes and their ecological values.**

Sub-topic. Waterlogging and its ecological consequences; Changing river channels. Flooding, sinkholes and their environmental consequences

### **Topic 4. Modern natural catastrophic processes and their ecological significance.**

Sub-topics: Atmospheric Vortexes, Hurricanes, Tornadoes; Dust and salt storms; Floods and their ecological consequences; Earthquakes and their ecological consequences; Snow avalanches and their ecological consequences; Mudflows and their ecological consequences; Landslides and their ecological consequences; Fires and their ecological consequences

### **Topic 5. Mapping of hazardous natural processes.**

Sub-topics: Use of GIS technologies and remote sensing data in the study of natural processes. Mapping the dynamics of natural processes.

### **Topic 6. Monitoring of hazardous natural processes**

Sub-topics: Types of monitoring. Predicting the occurrence of hazardous processes. Geoecological aspects of unfavorable natural and anthropogenic processes and phenomena

## Discipline «**Management of natural and technogenic risks**»

### **Topic 1. Man-made systems, risk analysis and sustainable development of society**

Sub-topics: Natural and Technogenic Systems. Risk and hazard concept; Risk indicators; Risk and Problems of Sustainable Development;

### **Topic 2. Sources of danger and classification of risks and hazards**

Subtopics: General risk profile; Individual and collective risks; Potential territorial and social risks; Environmental risk; Spatial distribution of hazardous phenomena and risks;

### **Topic 3. The structure of technogenic risk**

Sub-topics: Problems of Technogenic Safety; Classification and nomenclature of potentially dangerous objects and technologies; Natural and technogenic risks; Dangers of accidents and their consequences; General structure of technogenic risk analysis

### **Topic 4. Methods of analysis of technogenic risk.**

Sub-topics: Methods for Identifying Hazards. Basic definitions and concepts of the theory of reliability, safety and risk; Indicators of reliability, safety and risk; Statistical modeling method

### **Topic 5. Environmental risk**

Sub-topics: Basic principles and criteria of risk management Structure of environmental risk Risk to public health and environmental pollution;

## **6. Problems and methods of natural and man-made risks management**

Sub-topics: Economic mechanisms of safety and risk management; Regulatory regulation of safety and risk. Protection of the population from dangerous and emergency situations of natural, man-made character.

### **3. List of references.**

#### **Main:**

1. Акимов В.А., Лесных В.В., Радаев Н.Н. Основы анализа и управления риском в природной и техногенной сферах
2. Алымов В.Т., Тарасова Н.П. Техногенный риск. Анализ и оценка. Учебное пособие. М., 2001
3. Евсеева Н.С. Экологическая геоморфология. Опасные природные процессы: учебное пособие. – Томск : ТГУ, 2017. – 278 с.
4. Кочуров Б.И. Геоэкологическое картографирование. Учебное пособие. М., Академия. 2009.- 192 с.
5. Степанова Н.Ю. Техногенные системы и экологический риск. Учебное пособие. 2014.
6. Экологический риск. Научное издание. Составители: Ноговицын В.Н., Ноговицына. Иркутск, 2017. 362 с.

#### **Additional:**

1. Акимова Т.А. Экология. Человек. Экономика. Биота. Среда. Учебник для вузов. 2-е изд. / Т.А. Акимова. - М.: Юнити-Дана, 2002, 2006. - 566 с.
2. Витченко А.Н. Геоэкология. Курс лекций. Минск., 2002. 100 с.
3. Комарова Н.Г. Геоэкология и природопользование: учеб. пособие- М. : «Академия», 2010. - с. 256.
4. Протасова Н. А. Геохимия техногенных ландшафтов. Учебное пособие для вузов. 2009. -37 с.
5. Чернышов В.Н. Теория систем и системный анализ: учеб. Пособие. Тамбов : Изд-во Тамб. гос. техн. ун-та, 2008. – 96 с.
6. Экологическая геоморфология: новые направления: учеб. пособие /под ред. С.И. Болысова. М. : Географ. фак. МГУ, 2015. 220 с.