Appendix 13. Modular Reference Guide for the Degree Program "Ecology" (Master's)

Content

Module Title	**M 1. History and Philosophy of Science**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in philosophy, associate professor Spanov M.Zh.
Language of Instruction	Kazakh, Russian
Relation to the Programme / Curriculum Placement	Basic discipline, university component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; current independent work of learners – 50 hours; midterm supervised independent work – 15 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level course M 15 Philosophy
Module Aims and Intended Learning Outcomes	After completing this module, master's students are able to: -analyze the main worldview, methodological, and interdisciplinary issues of modern science; -critically evaluate scientific approaches, theories, and paradigms; -apply categories and principles of the philosophy of science when assessing scientific facts, phenomena, and processes; -formulate and solve problems arising in research activities requiring advanced professional knowledge; -analyze and interpret the realities of contemporary theory and practice based on the methodology of socio-humanitarian and natural sciences.
Indicative Content	**Lectures:** History and philosophy of natural and technical sciences; modern European science; science in culture and civilization; emergence of science, its historical dynamics, structure of scientific knowledge; philosophical problems of specific sciences; communicative technologies of the 21st century and their role in modern science; philosophical issues of contemporary global civilization; current methodological, philosophical, and philosophical problems in natural and social-humanitarian sciences, as well as specialized scientific fields according to the students' specialization **Practical classes:** Subject matter of the history and philosophy of science; worldview foundations of science; functions of the philosophy of science; emergence and development of science; modern European science; main concepts and directions of the non-classical and post-non-classical stages of science development; structural levels of scientific knowledge; science as a profession; philosophical foundations of science and scientific worldview; scientific traditions and scientific revolutions; history and philosophy of natural and technical sciences; history and philosophy of social and humanitarian sciences; philosophical problems of contemporary global civilization
Forms of Assessment / Examination	Current assessment: preparation of summaries and annotations on scientific articles and monographs, analysis of philosophical dilemmas and ethical issues of scientific knowledge. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. M.Sh. Khasanov, V.F. Petrova. *History and Philosophy of Science*. Almaty, 2011. 97 p. 2. A.V. Vidershpan. *History and Philosophy of Science: Textbook*. Kostanay: Kostanay Academy of the Ministry of Internal Affairs of RK named after Sh. Kabylbayev, 2016. 165 p. 3. E.V. Ushakov. *Introduction to the Philosophy and Methodology of Science: Textbook.* Moscow: Eksamen, 2005. 528 p. 4. D. McKaughan, H. VandeWall. *The History and Philosophy of Science: A Reader (Illustrated Edition)*. 2018. ISBN 1474232728. 1104 p.

	5. M. Heidelberger, F. Stadler. *History of Philosophy of Science*. 2002. ISBN 978-1-4020-0509-1. 442 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 2. Foreign Language (Professional)**
Semester(s) in which the module is taught	1th semester
Module Leader / Coordinator	PhD, associate professor Zhorabekova A.N.
Language of Instruction	English
Relation to the Programme / Curriculum Placement	Basic discipline, university component
Teaching and Learning Methods	Practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: practical classes – 45 hours; independent work of learners – 60 hours; supervised independent work – 15 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M 4 Foreign Language 1, M 9 Foreign Language 2, M 20 Professionally-Oriented Foreign Language
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -use a foreign language in oral and written form for interpersonal and professional communication, including the preparation and writing of scientific texts such as articles, abstracts, and presentations; -understand and interpret specialized literature within their field; -comprehend and interpret spoken professional content (lectures, reports, TV and online programs); -read and translate original professional literature with subsequent analysis; -participate in professional discussions, scientific debates, and round-table conversations; -present scientific research or articles in a foreign language; -utilize lexicographical resources in a foreign language.
Indicative Content	**Practical classes:** Reading: Developing reading skills through different types of reading (skimming, scanning, intensive, and extensive) of original foreign-language sources with varying levels of content coverage. Writing: Scientific reports, research abstracts, poster presentations, summarizing original foreign-language sources, annotating scientific texts, preparing resumes; fundamentals of business writing and documentation for international scientific collaboration. Listening: Listening to authentic professional materials delivered by native speakers in audio and video formats. Speaking: Delivering scientific reports, presentations, and oral research communications.
Forms of Assessment / Examination	Current assessment: Dialogues, round tables, debates. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. L. Soars. *New Headway Advanced Student's Book*. Oxford University Press, 2003. 2. L. Soars. *New Headway Upper-Intermediate Student's Book*. Oxford University Press, 2003. 3. L.G. Galaganova. *English for Master's Students: Textbook*. Kemerovo: KemGU, 2017. 288 p. ISBN 978-5-8353-2114-8. 4. R.S. Rashitova. *Collection of Lexical and Grammar Tests in English for Master's Students: Collection*. Ufa: BSPU named after M. Akmulla, 2015. 184 p. 5. *McDougal Littell. Writing Research Papers*. Longman, 2010.

Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 3. Management Psychology**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD, associate professor Sakhieva F. A.
Language of Instruction	Kazakh, Russian
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of students (current)– 50 hours; independent work of students (midterm)– 10 hours; supervised independent work – 15 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level course M17 Cultural Studies and Psychology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -observe and identify individual personality traits; -analyze various management situations effectively; -manage group and interpersonal processes, including their own behavior and the behavior of others; -select optimal leadership styles considering changes in the external environment; -choose appropriate motivation methods according to individual psychological characteristics; -make informed decisions; -create a favorable socio-psychological climate; -build effective approaches to employees.
Indicative Content	**Lectures:** Evolution of management thought; systematic perspectives on management; approaches to management; personality as an object of management; management schools; classical/administrative school and Henri Fayol's management principles; development of behavioral sciences; management science; communication; organization as an open system; classification of management models; Japanese management model. **Practical classes:** Functions of the management process: organization, motivation, control, linking processes; managerial communication; the role of communication in organizational management; motivation of individual behavior in organizations; conflict in organizations; comparative analysis of Japanese and American management models; socio-psychological foundations of managerial decision-making; issues of group efficiency.
Forms of Assessment / Examination	Current assessment: conflict resolution exercises, SWOT analysis, role-playing. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Akimova, *Y.N. Management Psychology: Textbook and Practical Guide for Universities, 2nd ed., revised and expanded*. Moscow: Yurayt, 2025. 364 p. ISBN 978-5-534-18847-9. 2. Ivanova, V.S. *Management Psychology: Textbook*. Tomsk: Tomsk Polytechnic University, 2011. 88 p. 3. Alieva, M.B., Magomedova, E.E., Rajabova, R.V., Umarieva, S.Z., Tsakhaeva, A.A. *Management Psychology*. Kyiv: Financial Rada Ukraine LLC, 2017. 146 p. 4. Gilbreth, L. *The Psychology of Management*. ISBN 1720347158. 2018. 254 p.

	5. Fisher, J. *The Psychology of Management & How to Talk to Anyone*. ISBN 9881595711. 2025. 782 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 4. Pedagogy and Psychology of Higher Education**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in pedagogical sciences, associate professor Suleimenova A.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of students (current)– 50 hours; independent work of students (midterm)– 10 hours; supervised independent work – 15 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level course M17 Cultural Studies and Psychology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -solve specific psycho-pedagogical tasks; -adapt to various changes and predict the development of situations; -create optimal conditions for the development of stable personal qualities within a holistic pedagogical process; -conduct research and exploratory work.
Indicative Content	**Lectures:** Pedagogy within the system of sciences; defining educational goals; model of a specialist's personality; competency-based approach in education; essence and structure of educational content; normative documents regulating educational content; principles and patterns of the learning process; teaching methods; pedagogical technologies; theory of education; psychology of higher education; psychological analysis of student activity; motivation of learning and cognitive activity; features of student personality development; adaptation of first-year students to university conditions. **Practical classes:** Role of higher education pedagogy within the system of sciences; competency-based approach; factors shaping higher professional education content; information and computer technologies in learning; types and significance of learning assessment; education as socialization; activities and cognitive processes; factors influencing students' learning success; adaptation issues of first-year students; socio-psychological characteristics of student groups; psychodiagnostic methods; personality testing; psycho-pedagogical competence of higher education teachers.
Forms of Assessment / Examination	Current assessment: role-playing games, brainstorming, business games. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Sharipov, F.V. *Pedagogy and Psychology of Higher Education: Textbook*. Moscow: Logos, 2012. 448 p. ISBN 978-5-98704-587-9 2. Bulanova, M.V. *Pedagogy and Psychology of Higher Education*. Rostov-on-Don: Phoenix, 2012. 544 p. 3. Grigorovich, L.A., Marcinkovskaya, T.D. *Pedagogy and Psychology: Textbook for Universities*. Moscow: Gardariki, 2009. 475 p. 4. Okhremenko, I.V. *Psychology and Pedagogy of Higher Education: Textbook for Bachelor's and Master's Programs*. Moscow: Yurayt, 2024. 175 p.

	5. Shershneva, T.V. *Pedagogy and Psychology of Higher Education*. Minsk: BNTU, 2023. 266 p. ISBN 9789855839331
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 5. Methods of Teaching Specialized Disciplines**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in technical sciences, Professor Kenzhibaeva G.S.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, university component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of learners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M25.1 Ecology and Sustainable Development, M25.2 Ecological Aspects of Natural Sciences, M46.1 Planning and Organization of Research Work, M46.2 Fundamentals of Scientific Research and Patent Studies
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -understand the main methods and forms of teaching specialized disciplines; -formulate educational objectives for specialized disciplines; -design different stages of teaching technology; -apply acquired knowledge to improve the learning process in practical teaching; -create a psychologically comfortable learning environment.
Indicative Content	**Lectures:** Competency-based and creative approaches in education; challenges and prospects of implementing the competency-based approach; modern teaching methods and their classification; the creative nature of university teaching; main psychological traits of personality (temperament, character, abilities); individual learning technologies; general principles of individualized learning; multimedia teaching technologies; teaching specialized disciplines through problem-solving and case studies; logical methods and techniques; trends in digital education; methodology for teaching specialized disciplines in ecology. **Practical classes:** Education from the perspective of competency-based approaches; additional education under competency-based principles; project-based learning; case studies; creative aspects of teaching; key psychological traits of personality; integrated learning in Kazakhstan; development of block-based and paracentric learning technologies; use of multimedia in teaching; analysis and solution of problem situations and cases; general logical methods of cognition; benefits and risks of digital education; methods for stimulating creative thinking; development of teaching materials; lesson planning and selection of teaching methods.
Forms of Assessment / Examination	Current assessment: development of teaching materials, business games. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Perebora, E.A. *Methods of Teaching Ecology at University*. Krasnodar: KubGAU, 2018. 101 p. ISBN 978-5-00097-680-7 2. Kuznetsova, E.V. *Interactive Teaching Methods in Ecology*. Yekaterinburg, 2021 3. Smirnova, N.N. Ecology: *Theory and Teaching Practice*. Kazan, 2022

	4. Edes, I. *Ecological Pedagogy*, 2022. 200 p. ISBN 9781645042594. Uzbek State World Languages University, Department of Natural Sciences. https://doi.org/10.5281/zenodo.14561323 5. *Teaching and Learning in Ecology: A Horizon Scan of Emerging Challenges and Solutions*, Oikos 130(1), September 2020. DOI:10.1111/oik.07847
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 6.1. Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in chemistry, professor Iztleuov G.M.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of students – 60 hours; supervised independent work – 25 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M29.1 Environmental Monitoring, M29.2 Environmental Monitoring of Industrial Facilities
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -analyze and evaluate information obtained in the course of environmental monitoring for decision-making in professional activities; -identify and interpret monitoring data to assess the impact of anthropogenic activities on the environment; -design a comprehensive environmental monitoring programme for a selected environmental component or enterprise; -apply knowledge of super-ecotoxicants to select optimal environmental monitoring methods.
Indicative Content	**Lectures:** Main objectives of eco-analytical monitoring of super-ecotoxicants, regulatory, technical, and methodological support, legal regulation of ecological and analytical monitoring of super-ecotoxicants. Analysis of the current situation in the Republic of Kazakhstan and other countries regarding environmental pollution by super-ecotoxicants. Classification of super-ecotoxicants: physicochemical properties and distribution in natural environments. Polychlorinated dioxins, dibenzofurans and diphenyls, organochlorine pesticides, polycyclic aromatic hydrocarbons, nitrosamines, aflatoxins. Monitoring of surface waters, bottom sediments, soils, and vegetation. **Practical classes:** Specifics of analyzing trace impurities of pollutants, screening methods in the analysis of super-ecotoxicants. Quality assessment of analytical results, sampling methods for super-ecotoxicants. Sampling of air, water and sediments, soil, bottom sediments, and plant material. Collection of biological samples and food products. Sample preparation methods for analysis. Storage and preliminary preparation of samples
Forms of Assessment / Examination	Current assessment: case analysis, selection of optimal monitoring strategies. Final assessment: written or oral examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.

Reading List (Essential and Recommended Literature)	1. Iztleuov, G.M., Turebekova, G., & Dairabaeva, A.Zh. *Environmental Monitoring: Training Manual*. Shymkent: SKSU, 2021. 116 p. 2. Berdenov, Zh.G., et al. *Geo-ecological Monitoring*. Almaty: Evero, 2020. 312 p. 3. Abisheva, T.O. *Environmental Monitoring: Textbook*. Almaty: New Book, 2018. 160 p. 4. Iztleuov, G.M., & Turebekova, G. *Air Basin Protection*. Shymkent: SKU, 2023. 112 p. 5. Iztleuov, G.M., & Turebekova, G. *Industrial Ecology: Training Manual*. SKSU, 2023. 124 p. 6. Speight, J. *Environmental Organic Chemistry for Engineers*. 2017. ISBN 978-0-12-804492-6. 524 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 6.2. Digitalization in Ecology and Environmental Management**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in chemistry, professor Iztleuov G.M.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of students (current) – 60 hours; supervised independent work – 15 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M29.1 Environmental Monitoring, M29.2 Environmental Monitoring of Industrial Facilities
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -understand the principles of information technologies applied in environmental protection; -solve standard professional tasks in ecology, environmental management, and conservation; -analyze environmental and resource-management problems using digital tools and technologies in line with professional needs; -apply the principles of modern digital and information technologies to solve tasks in ecology and environmental management.
Indicative Content	**Lectures:** Digital economy in ensuring environmental safety. IT technologies for monitoring natural-anthropogenic systems, digital services in the field of nature management. Strategy for digital transformation of the ecology and nature management sector, application of digital technologies in ecology and nature management. Artificial intelligence for analyzing environmental monitoring data. Forecasting of hazardous meteorological phenomena and fire risks in forests. Real-time decision-making automation in ecology. Artificial information environment (AIE) in nature management. **Practical classes:** Digital image processing: principles and technologies. Methods of digital image processing and pattern recognition. Earth remote sensing from space, technologies for space-based remote sensing of the Earth in optical and radio ranges. Key digital technologies: cloud computing (Cloud Computing), big data (Big Data), Internet of Things (IoT), artificial intelligence (Artificial Intelligence). Analytics in cloud services. Data analysis using Yandex DataLens. Geographic Information Systems (GIS) in ecology.
Forms of Assessment / Examination	Current assessment: case analysis and selection of optimal solutions Final assessment: examination

Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Ospanov, G.S., & Bozshataeva, G.T. *Ecology: Textbook*. Shymkent: SKU, 2021. 176 p. 2. Iskakova, M.O., & Seitova, M.O. *Ecology in Numbers and Problems*. Almaty: CyberSmith, 2021. 152 p. 3. Iztleuov, G.M., & Turebekova, G. *Air Basin Protection*. Shymkent: SKU, 2023. 112 p. 4. Iztleuov, G.M., & Turebekova, G. *Industrial Ecology*: *Training Manual*. SKSU, 2023. 124 p. 5. Walker, M. Digital Ecology. 2025. ISBN 1326666371. 195 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 7.1. Organization of Environmental Audit**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD, senior lecturer Tileuberdi A.N.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of learners – 50 hours; supervised independent work – 25 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M29.1 Environmental Monitoring, M29.2 Environmental Monitoring of Industrial Facilities, M37.1 Fundamentals of Environmental Regulation and Expertise, M37.2 Environmental Expertise and Audit in Industry, M42.1 Emissions into the Environment and Their Calculation, M42.2 Standards for Environmental Emissions
Module Aims and Intended Learning Outcomes	After completing this module, master's student will be able to: -identify the goals, principles, and objectives of state environmental audit; -describe the main types of environmental audit and the foundations of their implementation; -apply knowledge and skills to conduct environmental audits in practice; -discuss mandatory environmental audit requirements and their specific features; -summarize legislative and methodological foundations of environmental expertise; -justify and explain the rights of environmental auditors.
Indicative Content	**Lectures:** Definition, purpose, principles, and tasks of state environmental expertise. Legislation in the field of environmental expertise. Environmental audit. Types of environmental audit and fundamentals of its implementation. Conducting an environmental audit. Decision on mandatory environmental audit. Specifics of mandatory environmental audit. Requirements for environmental audit reports. Environmental auditors. Audit of environmental management systems. Rights of environmental auditors. **Practical classes:** Study of basic concepts and definitions. History of environmental expertise and environmental audit in Kazakhstan and abroad. Determining the role of environmental expertise in addressing problems of various states and protecting Earth's natural resources. Study of the rights and responsibilities of special state bodies and authorized bodies at various levels that ensure environmental expertise. Identification of objects of public environmental expertise, procedures, and conditions of

	expertise. Issues of access to information for environmental expertise. Conclusion of public environmental expertise.
Forms of Assessment / Examination	Current assessment: written and oral assessments, presentation defence, group project defence, combined assessment format. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Fedorov, Yu.A., Ovsepyan, A.E., & Bellinger, O.Yu. *Ecological Design, Expertise, Audit and Management*. Southern Federal University, 2024. 145 p. ISBN 978-5-9275-4640-4 2. Gagina, N.V. *Environmental Design and Environmental Impact Assessment.* Minsk: BSU, 2021. 114 p. 3. Kolesnikov, E.Yu. *Environmental Impact Assessment. Safety Expertise*. Moscow: Urait, 2020. 469 p. 4. Shingisbayeva, Zh.A. *Organization of Environmental Audit: Lecture Course for Master's Students (6M060800 Ecology)*. Shymkent: SKSU, 2015. 5. Vanguilder, C. *Environmental Audits*. 2014. ISBN 978-1-938549-60-1. 205 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 7.2 Environmental Management**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD, senior lecturer Tileuberdi A.N.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 120 hours: lectures – 30 hours; practical classes – 15 hours; independent work of learners – 50 hours; supervised independent work – 25 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	Bachelor-level courses: M29.1 Environmental Monitoring, M29.2 Environmental Monitoring of Enterprises, M37.1 Fundamentals of Environmental Regulation and Expertise, M37.2 Environmental Expertise and Audit in Production, M42.1 Emissions into the Environment and Their Calculation, M42.2 Regulation of Emissions into the Environment
Module Aims and Intended Learning Outcomes	After completing this module, master's student is able to: -understand international, national, and corporate standards of environmental management -apply modern methods of environmental planning, analysis, and monitoring -conduct a comprehensive assessment of the environmental efficiency of industrial processes -argue the necessity of implementing environmental innovations and tools of the "green economy" in professional practice
Indicative Content	**Lectures:** Theoretical and methodological foundations of environmental management. System of environmental governance bodies. International standards and environmental management systems. Environmental costs of production and ways to reduce them. Regulation of environmental quality. Practical methods for managing environmental quality. Waste management. ISO 14000 standard system. **Practical classes:** Analysis of modern concepts and models of environmental management. Implementation of environmental management. Procedures and stages of ISO 14000. Analysis of

	international environmental management standards (ISO 14001, EMAS). Stages of implementing an EMS in an enterprise. Development of environmental policy and enterprise objectives.
Forms of Assessment / Examination	Current assessment: written and oral quizzes, presentation defence, group project defence, combined assessment. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. M. Shishov. *Ecological Management and Audit*. Ural University Publishing, 2016. 80 p. ISBN 978-5-7996-1749-3 2. Izmalkova S.A., Avdeeva I.L., Golovina T.A., Bakhtina S.S., Parakhina L.V. *Environmental Management: Textbook*. Orel: Gosuniversitet-UNPK, 2013. 164 p. ISBN 978-5-93932-580-6 3. Fedorov Yu.A., Ovsepyan A.E., Bellinger O.Yu. *Environmental Design, Expertise, Audit and Management*. Southern Federal University, 2024. 145 p. ISBN 978-5-9275-4640-4 4. Theodore, M.K. *Environmental Management*. Springer, 2021. 556 p. ISBN 9781003171126 5. Fath, B. *Environmental Management*. 2022. 937 p. ISBN 9780367515430
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 8 Research Work of the Master's Student 1**
Semester(s) in which the module is taught	1st semester
Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibayeva G.S.; PhD in chemistry, professor Iztleuov G.M.; PhD in technical sciences, associate professor Abuova A.A.; PhD in technical sciences, professor Sagitova G.F.; PhD, senior lecturer Tileuberdy A.N.; PhD in technical sciences, professor Issayeva R.A.; PhD in technical sciences, professor Shingysbayeva Zh.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Research work of the master's student
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total workload – 45 hours
Number of Credits (ECTS)	1 ECTS
Prerequisites and Recommended Prior Knowledge	M6.1 Environmental Monitoring of Hazardous Chemical Compounds – Superecotoxicants, M6.2 Digitalization in Ecology and Environmental Management
Module Aims and Intended Learning Outcomes	After completing the research work in the first semester, the master's student is able to: -formulate the aim, research questions, research object and subject of the Master's thesis -conduct dissertation research using advanced information technologies -carry out scientific research in environmental protection -apply advanced international experience in environmental protection and rational use of natural resources, relying on current scientific and industrial practices -prepare a research work report and defend the obtained scientific results
Indicative Content	Analysis of modern scientific and technological achievements in the chosen research field and study of practical recommendations and methods for solving research problems. Justification of the relevance of the selected research topic. Literature review and patent search of new waste utilization

	methods using electronic databases. Formulation of research objectives. Preparation and defence of the research work report for the 1st semester.
Forms of Assessment / Examination	Final assessment – pass-fail grading test
Learning and Examination Requirements	During the semester, students must complete all tasks in accordance with the individual study plan and obtain 30–60 points for current assessment.
Reading List (Essential and Recommended Literature)	1. Brodsky A.K. *Planning and Structuring Research Work. 2nd edition*. Moscow: Academia, 2010. 256 p. 2. GOST 7.32–2001. Research Work Report. Structure and Formatting Rules. 3. Zainulin Kh.N. Industrial and Municipal Waste Management. Ufa: Dialog, 2005. 292 p. 4. Sabyrkhanov D.S., Tasibayeva Sh.B., Baizhanova S.B. *Methodological Guidelines for Planning, Writing and Defence of the Master's Thesis*. Shymkent: M. Auezov SKSU, 2016. 50 p. 5. QMS SKU PR 7.28–2024. Organization and Implementation of Scientific (Experimental) Research Work of Master's and Doctoral Students.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 9 Teaching practice**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Bektureyeva G.U.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Additional types of training
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total Workload - 120 hours
Number of Credits (ECTS)	4 ECTS
Prerequisites and Recommended Prior Knowledge	M4 Pedagogy and Psychology of Higher Education, M5 Methods of Teaching Major courses
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -professionally apply basic methodological techniques in conducting academic classes, demonstrating understanding of the structure and aims of the educational system -apply logical and critical thinking to solve problems in environmental protection and natural resource management -demonstrate the ability to conduct classes and communicate effectively with individual students and groups -apply innovative teaching methods and manage time effectively in pedagogical activities -combine existing methodological approaches and respond professionally to diverse student needs -improve their self-education and assess students' learning results and academic achievements
Indicative Content	Development of professional and research culture in the field of environmental protection and natural resource management as a prerequisite for pedagogical excellence and creativity. Formation of professional pedagogical skills in the field of environmental education, scientific and pedagogical thinking. Preparation of teaching and methodological materials for Major courses. Preparation and teaching of practical and laboratory classes in Bachelor-level disciplines in Ecology. Development and implementation of new active teaching methods. Attendance of lectures delivered by leading faculty members, participation

	in educational, methodological and extracurricular work with students. Participation in seminars and conferences on modern teaching methods.
Forms of Assessment / Examination	At the end of the teaching practice, the student must prepare and defend a practice report and obtain 30–60 points for current assessment.
Learning and Examination Requirements	Final assessment – pass-fail grading test
Reading List (Essential and Recommended Literature)	1. Kuzmina, N. V. *Professionalism of the Teacher and Vocational Training Master.* St. Petersburg: Piter, 2021. 2. Sarsenbayeva, G. K. *Methods of Organizing Teaching Practice in Higher Education*. Almaty: Kazakh University, 2022. 3. Konysbayeva, L. A. Teaching *Practice of Master's Students: Content, Organization, Analysis*. Nur-Sultan: ENU, 2021. 4. Fullan, M. *The New Meaning of Educational Change*. New York: Teachers College Press, 2015. 5. Pérez, C. R., Shohel, M. M. C. (Eds.). *Pedagogy in Contemporary Education.* London: IntechOpen, 2024, 262 p. ISBN 978-0-85014-063-7. DOI 10.5772/intechopen.111318.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 10.1 Current Issues in Geoecology and Landscape Ecology**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, professor Isayeva R.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload - 150 hours: Lectures – 30 hours; Practical classes – 30 hours; Independent work of learners – 55 hours; Supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M6.2 Digitalization in Ecology and Environmental Management, M7.1 Organization of Environmental Audit, M7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -generalize and correctly use geoecological and environmental terminology -construct the dynamics of geoecological processes resulting from anthropogenic pressure and natural disasters -interpret and analyze the state of geosystems and the environment -organize and conduct field and experimental geoecological research -identify and classify geoecological problems in the Republic of Kazakhstan
Indicative Content	**Lectures:** Landscape ecology as a multidisciplinary research field studying interactions between the Earth's geospheres. Changes in geospheres caused by human activity and emerging geo-economic problems. Key concepts, objects, tasks and methods in addressing current geoecological challenges, reclamation of agricultural lands, and protective afforestation. Theoretical and methodological foundations of solving contemporary problems in geoecology and landscape ecology. Spatial analysis methodology, linkages between landscape characteristics and ecological processes. Socio-economic processes as drivers of land use change and landscape transformation. Optimization of landscape structure for biodiversity conservation, landscape resilience, and ecosystem management. **Practical classes:** Study of geoecological and environmental terminology. Identification of global environmental challenges. Assessment of anthropogenic transformation of the Earth's ecosystems. Analysis of world

	population as a geoecological factor. Study of natural resources of Kazakhstan, their regional and national characteristics. Scientific and technological progress and its role in the formation of the global environmental crisis. Socio-economic drivers of land-use change and landscape transformation. Landscape structure optimization for biodiversity and sustainability. Methods of spatial data collection and evaluation of data reliability and accuracy.
Forms of Assessment / Examination	Current assessment: presentation defence, combined form of oral evaluation. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Current Issues of Geoecology and Landscape Science (collection of scientific articles), Issue 4. Minsk: Belarusian State University, 2017, 163 p. 2. Smagulov, A. Zh., & Beysembinov, Zh. K. *Landscape Ecology and Sustainable Nature Management: Modern Challenges and Methods*. Astana: L.N. Gumilyov ENU, 2023, 205 p. 3. Lavrov, S. B., & Kasymov, B. T. *Current Problems of Geoecology in Kazakhstan: Natural–Anthropogenic Processes and Sustainable Development*. Almaty: KazNU, 2022, 174 p. 4. Nesterov, E. M., & Snytko, V. A. (Eds.). *Geoecology and Evolutionary Geography: Modern Research Directions*. St. Petersburg: St. Petersburg State University Press, 2020, 256 p. 5. Wiersma, Y. F. *Experimental Landscape Ecology*. Cham: Springer, 2022, 217 p. ISBN 978-3-030-95188-7
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 10.2. Rational Use of Natural Resources**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, professor R.A. Issayeva
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of learners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -know the natural resource potential of Kazakhstan, its regional features and formation factors -understand modern technologies and innovations in energy efficiency, resource saving and circular economy -analyze and interpret the principles of rational natural resource use and sustainable development -apply methods of cartographic and spatial analysis using GIS technologies -apply international and national environmental policy standards
Indicative Content	**Lectures:** Evolution of approaches to the use of natural resources: principles of rationality and sustainability. Natural resource potential of Kazakhstan and its regional characteristics. Mechanisms for managing

	rational resource use. Sectoral aspects of rational natural resource use. Modern technologies and innovations in resource-efficient development. International cooperation in the field of rational natural resource use. The "Green Economy" and "Zhasyl Damu" programmes, Environmental Code of the Republic of Kazakhstan, strategic trends until 2035. **Practical classes:** Analysis of rational natural resource use principles. Assessment of regional natural resource potential. Calculation of ecological and economic efficiency of resource use. Development of conditional limits for industrial resource extraction and use. Application of GIS datasets and statistical materials; cartographic analysis. Comparison of primary and secondary resources; processing efficiency indicators.
Forms of Assessment / Examination	Current assessment: successful completion of graphic calculations; colloquia, written assignments; written and oral questioning. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Wang, L. K., Wang, M. S., Hung, Y.-T., Shammas, N. K., et al. (2021). *Integrated Natural Resources Management*. Springer Nature. 2. Kumar, R., et al. (2024). *Sustainability of Natural Resources: Planning, Development, and Management*. CRC Press. 3. Gurova, T. F., & Nazarenko, L. V. (2024). *Ecology and Rational Use of Natural Resources: Textbook and Practical Guide for Universities*. Moscow: Yurayt. 4. Derevenskaya, O. Yu. (2023). *Rational Use of Natural Resources: Teaching Manual.* 5. Zhanadilov, T., & A. Yu. (2021). *Ecology and Environmental Activities*. Almaty: LP-Zhasulan. ISBN 978-601-7141-56-1.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 11.1. Environmental Impact Assessment**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Bektureyeva G.U.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 45 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -study and apply in practice the methods for assessing environmental, socio-economic and other consequences of planned activities, including risk assessment -apply EIA for environmental quality management and rational use of natural resources, considering international practice -analyze environmental consequences of various types of economic activity -assess environmental aspects of industrial and infrastructural projects -justify the specific features of environmental impact assessment for different territories and facilities.

Indicative Content	**Lectures:** Environmental Impact Assessment (EIA): basic concepts and principles. Mandatory nature of EIA. Stages and procedures of EIA. Types of impacts considered within EIA. Classification of EIA objects by significance and scope of assessment. EIA documentation requirements. Methodological support for conducting EIA. Specifics of EIA for projects with transboundary environmental impact. **Practical classes:** Review of national environmental legislation. Study of the EIA procedure in Kazakhstan. Work with EIA documentation. Identification of impact types and assessment criteria. Classification of projects by significance. Analysis of transboundary environmental impact cases.
Forms of Assessment / Examination	Current assessment: graphic calculations, colloquia, written assignments, written and oral questioning. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Environmental Code of the Republic of Kazakhstan, 2 January 2021, No. 400-VI. Article 64 “Environmental Impact Assessment”; Article 67 “Stages of Environmental Impact Assessment.” 2. Hundloe, T. (2021). *Environmental Impact Assessment: Incorporating Sustainability Principles*. Palgrave Macmillan. ISBN 978-3-030-80941-6. 3. Bhateria, R., Sharma, M., Singh, R., & Kumar, S. (2024). *Environmental Impact Assessment: A Journey to Sustainable Development*. Springer Cham. ISBN 978-3-031-66796-1. 4. Zozulya, P. V., & Zozulya, A. V. (2021). *Environmental Impact Assessment: Textbook and Practical Guide*. Knorus. ISBN 978-5-406-06642-3. 5. Belyuchenko, I. S., Melnik, O. A., & Teuchezh, A. A. (2018). *Environmental Impact Assessment: Teaching Manual*. Krasnodar: KubGAU. ISBN 978-5-00097-751-4.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 11.2. Environmental Assessment and Cartographic Mapping of the Southern Region**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Bektureyeva G.U.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 45 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master’s student is be able to: -independently conduct mapping and apply methods of ecological cartography in the field -identify and select information sources for cartographic mapping according to departmental affiliation -analyze results of ecological mapping and mapping methodologies

	-apply scientific approaches and technical methods of ecological mapping and assessment -independently carry out applied ecological mapping and cadastral mapping of geographic pollution -apply environmental standards in professional activities and in decision-making processes
Indicative Content	**Lectures:** Theoretical foundations of ecological mapping and assessment. Methods and structure of ecological maps. Mapping atmospheric pollution, surface water pollution, physical pollution, soil contamination and other depositional environments. Mapping geological and geomorphological contamination. Bioecological aspects of mapping. Geographic analysis of environmental pollution. **Practical classes:** Cartographic projections. Map layout and orientation. Classification of information sources by departmental affiliation. Map grid and nomenclature. Relief representation. Classification of ecological mapping sources according to scientific methods and technical tools. Sources for creating maps and atlases. Map language and cartographic generalization. Map project design and publication. Map legends. Territorial interpretation of ecological-geographical information. Methods of map use. Geographic coordinate system. Bioecological aspects of mapping. Direction angles. Profile construction. Relief representation.
Forms of Assessment / Examination	Current assessment: successful completion of graphical calculations; colloquiums, written tests; written and oral surveys. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Ogureeva, G. N. (2022). *Ecological Cartography: Textbook for Universities*. Moscow: Yurayt. 2. Rakhmatullina, I. R. (2018). *Ecological Cartography: Practical Manual*. Ufa: BSPU Publishing. 3. Belyuchenko, I. S. (2017). *Ecological Cartography: Textbook*. Krasnodar: KubGAU. 4. *Mapping the World: An Illustrated History of Cartography*. (2005). 402 pp. 5. Kochurov, B. I., & Shishkina, D. Yu. (2009). *Geoecological Cartography*. Moscow: Akademiya.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 12.1. Study of Recent Advances in Waste Processing**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibaeva G.S.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to:

	-assess the environmental impact of various types of waste on ecosystem components and the environment -calculate hazard classes and accumulation standards for waste in professional tasks -evaluate hazard classes and distinguishing characteristics of different types of waste -apply regulations for storage and transportation of different waste types to protect ecosystems at various levels -know the main methods and technologies for neutralization, processing, and disposal of industrial and municipal waste -apply methods for organizing and managing industrial and municipal waste
Indicative Content	**Lectures:** Waste classification, volumes, and main directions of processing. Key technologies for industrial waste processing. Integrated processing of raw materials and production waste. Zero-waste technologies for industrial waste. Handling toxic (hazardous) industrial waste. Radioactive waste processing technologies. Waste from mining enterprises. Soil pollution from industrial waste. Uses of products from industrial waste. Solid municipal waste and main processing technologies. Ecological rationalism in natural resource use and environmental improvement. Waste environmental monitoring. State, industrial, and public control in waste management. Prospective technologies for industrial and municipal waste processing **Practical classes:** Hazard classification of waste. Key technologies for industrial waste processing. Development of integrated raw material and production waste processing. Zero-waste technologies for industrial waste. Analysis of waste hazards and toxic effects on living organisms. Radioactive waste processing. Waste management in mining enterprises. Analysis of soil pollution from industrial waste. Application of products from industrial waste. Management of solid municipal waste and main processing technologies. Environmental rationalism and environmental improvement. Waste environmental monitoring. State, industrial, and public control in waste management. Prospective waste processing technologies **Laboratory classes:** Ecological models of technological processes. Industrial waste utilization. Pyrolysis of polymer waste. Production and characterization of activated carbons from industrial waste. Processing of pyrite cinders to obtain colored pigments. Study of storage and landfill processes for municipal solid waste. Post-closure uses of landfills. Design and calculation of landfills for industrial and municipal waste.
Forms of Assessment / Examination	Current assessment: colloquia, written assignments, written and oral questioning Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Gabov, Y. A., & Kist, V. E. (2018). *Waste of Kazakhstan and problems of their utilization* (Parts 1–3). Almaty: New Book. 2. Bhat, R. A., Dar, G. H., & Hajam, Y. A. (Eds.). (2024). *Zero Waste Management Technologies.* ISBN 9783031572746. 3. Choudhury, A. R. (2024). *Material and Energy Recovery from Solid Waste for a Circular Economy*. CRC Press. ISBN 1032399767. 4. Behera, I. D., & Das, A. P. (Eds.). (2024). *Impact of Petroleum Waste on Environmental Pollution and Its Sustainable Management Through Circular Economy*. ISBN 9783031482199. 5. Selvasembian, R., Wan Azelee, N. I. B., Saravanan, R. S., Ponnusami, V., & Mishra, A. K. (Eds.). (2023). *Valorization of Wastes for Sustainable Development: Waste to Wealth*. ISBN 0323958729.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 12.2. Modern Methods and Measurement Tools in Ecology**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibaeva G.S.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -analyze modern methods, principles, and techniques of monitoring and measurement in environmental quality regulation -independently select instruments and equipment and conduct environmental assessments -apply modern methods, principles, and techniques for environmental quality monitoring and control
Indicative Content	**Lectures:** Methods and tools for observing and monitoring environmental conditions. Air pollution control: sampling equipment and methodologies, standard mixtures of pollutants with air. Modern methods for monitoring air pollution. Measurement of harmful substances using indicator tubes. Water pollution control: organization of water quality monitoring, types of samples and sampling methods, devices for water sampling, techniques for hydrosphere pollution monitoring. Soil pollution control: sampling and monitoring methods. Instrumental analysis methods: spectroscopic, electrochemical, chromatographic, and radiometric analysis. **Practical classes:** Eco-analytical control within environmental monitoring systems. Organization of sampling during environmental monitoring. Modern methods of analyzing environmental components (contact and non-contact methods). The role of sample preparation in environmental component analysis. **Laboratory classes:** Determination of iron content by spectrophotometric method. Measurement of petroleum hydrocarbons in wastewater using fluorimetric analysis. Soil moisture determination by standard and rapid methods. Sample preparation of solid materials for spectral analysis. Measurement of pH in natural waters and soil extracts using potentiometric method.
Forms of Assessment / Examination	Current assessment: group projects, presentations, written and oral questioning Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Nikiforenko, Y. Y., & Melnik, O. A. (2022). *Methods of Environmental Research: Textbook.* Krasnodar: KubGAU. ISBN 978-5-907550-36-0. 2. Trubina, O. A. (2014). Fundamentals of Computer Data Processing in Ecology: Practical Guide. Novosibirsk: SGGA. 3. Ryazanova, N. E. (2019). *Methods of Environmental Research: Textbook*. Moscow: INFRA-M. 4. Kotikov, Y. G. (2016). *Geoinformation Systems: Textbook*. Saint Petersburg: St. Petersburg State University of Architecture and Civil Engineering, EBS ASV.

	5. Mukhopadhyay, S. C., & Jiang, J.-A. (Eds.). (2013). *Wireless Sensor Networks and Ecological Monitoring*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-36365-8
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 13.1. Green Technologies in Production and Transport**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in chemistry, professor Iztleuov G.M.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of students (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -master basic methods for organizing state environmental control of pollutant emissions in transport enterprises -analyze environmental management in the transport and logistics sector of Kazakhstan -participate in quality management of transport-technological machines and complexes -determine prospects for the development of green technologies, maintenance, and repair of transport equipment -apply and practice green technologies in transport
Indicative Content	**Lectures:** Traditional energy sources. New energy-saving and energy-accumulating technologies. Biofuels. Water conservation and recycling. Waste processing and recycling. Nanomaterials and nanotechnologies as the future of eco-technologies. Green spaces. Industrial impact on the environment and methods of greening. Basics of eco-design and eco-projecting. Green transport. Green cities. Principles of rational use of natural resources in developing green technological processes and equipment for industrial and household waste treatment and recycling. **Practical classes:** Determination of technical operation standards for transport equipment. Information support for functionality and diagnostics of transport equipment. Analysis of the role of green technologies in transport maintenance and repair. Determination of technical maintenance systems for green technologies. Prospects for the development of green technologies, maintenance, and repair of transport equipment. Overview of technological processes ensuring resource-saving and low-waste technologies in transport. Identification of sources, types, and objects of environmental impact from transport. Regulatory support for environmental safety in transport operations. Methods for calculating emissions from transport equipment in operation.
Forms of Assessment / Examination	Current assessment: group projects, reports, written and oral questioning. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.

Reading List (Essential and Recommended Literature)	1. Baubekov, E.E., & Begimkulova, E.A. (2021). *Environmental Safety of Motor Vehicles: Textbook.* Almaty: Academy of Logistics and Transport. 92 p. 2. Sabraliev, N.S. (2018). *Reduction of Greenhouse Gas Emissions from Automobiles: Teaching Manual*. Almaty: New Book. 184 p. 3. Sakibaeva, S.A., Iztleuov, G.M., & Kaldikozov, E.K. (2020). *Green Technology: Biofuel: Training Manual*. Shymkent: SKSU. 125 p. 4. Iztleuov, G.M., & Turebekova, G. (2023). *Industrial Ecology: Training Manual.* SKSU. 124 p. 5. Iztleuov, G.M., Turebekova, G., & Dairabaeva, A.Zh. (2021). *Ecological Chemistry: Training Manual.* Shymkent: SKSU. 120 p. 6. Weiss, M., Heywood, J., Drake, E., Schafer, A., & AuYeung, F. (2000). *On the Road in 2020: A Life Cycle Analysis of New Automobile Technologies. Massachusetts Institute of Technology*. 201 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 13.2. Environmental Control and Monitoring of Technogenic Ecosystems**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in chemistry, professor Iztleuov G.M.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of students (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -critically analyze monitoring data to assess the impact of anthropogenic activity on the environment -design a comprehensive environmental monitoring program for a selected environmental component, territory, or enterprise -prepare a report on the status of observation systems for the analyzed territory or enterprise -evaluate monitoring data to form professional judgments and make informed decisions
Indicative Content	**Lectures:** Modern concepts and principles of environmental control and monitoring. Methods of systems analysis and modeling. Regulatory and methodological support for environmental control. Methods and technologies of environmental monitoring. Geoinformation and remote sensing methods. Processing and interpretation of environmental monitoring data. **Practical classes:** Analysis of the structure and components of technogenic ecosystems. Identification of anthropogenic impact sources and construction of matter and energy flow diagrams. Development of an environmental monitoring program: defining goals, objects, observation parameters, frequency, and measurement methods. Determination of pollutant concentrations using spectrophotometers, ionometers, gas analyzers, etc. Conducting biotesting (e.g., Daphnia, Lemna), assessment of biodiversity and bioindicator indices. Evaluation of environmental risk and contamination levels of territories.

Forms of Assessment / Examination	Current assessment: group projects, reports, written and oral questioning, graphical assignments Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Protasov, V.F. (2013). *Environmental Foundations of Natural Resource Management: Textbook*. Moscow: Alpha-M, INFRA-M. 2. Yasoveev, M.G., Streha, N.L., Kakareka, E.V., et al. (2015). *Environmental Monitoring and Environmental Expertise: Textbook for University Students*. Minsk; Moscow: Novoe Znanie, INFRA-M. 304 p. 3. Potapova, E.V. (2014). *Environmental Monitoring: Textbook*. Irkutsk: Irkutsk State University Publishing. 162 p. ISBN 978-5-9624-1079-0 4. Roberts, S. (2000). *Environmental Monitoring*. Germany: Springer-Verlag. 208 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 14. Master's Student Research Work 2**
Semester(s) in which the module is taught	2nd semester
Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibaeva G.S. PhD in chemistry, professor Iztleuov G.M. PhD in technical sciences, associate professor Abuova A.A. PhD in technical sciences, professor Sagitova G.F. PhD, senior lecturer Tileuberdy A.N. PhD in technical sciences, professor Isaeva R.A. PhD in technical sciences, professor Shingisbaeva Zh.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Master's Student Research Work
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total workload – 45 hours
Number of Credits (ECTS)	1 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -apply theoretical knowledge in environmental protection and rational natural resource use to conduct experimental work -carry out scientific research in environmental protection and rational natural resource use and draw conclusions based on research results -justify and develop technological regimes for low-waste and waste-free technologies -perform technological calculations related to the topic of the dissertation research
Indicative Content	Analysis of current scientific and technical achievements in a specific production area with the study of practical recommendations and methods for solving research tasks. Justification of the relevance of the chosen research topic. Conducting a literature review and patent search for new waste utilization methods in the studied research area of the master's thesis using electronic databases. Setting research objectives. Preparation and defense of the report on the master's research work for the 1st semester.
Forms of Assessment / Examination	Final assessment: pass-fail grading test

Learning and Examination Requirements	During the semester, master's student must complete assignments according to the individual plan and obtain 30–60 points.
Reading List (Essential and Recommended Literature)	1. SMK SKU PR 7.28-2024. Organization and Conduct of Scientific (Experimental) Research Work for Master's and Doctoral Students. 2. SMK SKU PR 7.29-2024. Organization of Scientific Internship for Master's and Doctoral Students.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 15. Research Practice**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibaeva G.S. PhD in chemistry, professor Iztleuov G.M. PhD in technical sciences, associate professor Abuova A.A. PhD in technical sciences, professor Sagitova G.F. PhD, senior lecturer Tileuberdy A.N. PhD in technical sciences, professor Isaeva R.A. PhD in technical sciences, professor Shingisbaeva Zh.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Additional types of training
Teaching and Learning Methods	Independent research practice
Workload (including contact hours and independent study)	Total workload – 180 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 6.1 Environmental Monitoring of Hazardous Chemical Compounds – Super Ecotoxicants, M 6.2 Digitalization in Ecology and Environmental Management, M 7.1 Environmental Audit, M 7.2 Environmental Management
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -formulate goals and objectives for experimental fundamental and technological research -independently develop plans for conducting experimental scientific research -conduct scientific research using modern physico-chemical analytical methods -process and interpret obtained results and use them to solve scientific and technological problems in the field of environmental protection
Indicative Content	Analytical review of known waste utilization methods in the studied research area and new low-waste and waste-free technologies in accordance with the objectives and tasks of the dissertation research. Conducting theoretical and experimental studies related to the dissertation according to the individual plan; analysis of raw materials and reagents used for scientific research; performing laboratory experiments related to the master's dissertation. Processing and interpreting obtained research results and forming conclusions for the respective section of the study.
Forms of Assessment / Examination	Final assessment: pass-fail grading test
Learning and Examination Requirements	During the internship, the master's student must complete assignments according to an individual plan and 30 - 60 points.
Reading List (Essential and Recommended Literature)	1. Saushkin, I. A., et al. *Methodology and Organization of Scientific Research in Ecology.* Moscow: Akademiya, 2020. 2. Stadnichenko, A. A. *Methods of Ecological Research*. St. Petersburg: Lan, 2019. 3. Smirnov, V. I., Kuznetsova, T. V. *Modern Methods and Instruments for Ecological Monitoring*. Moscow: Infra-M, 2021.

	4. Southwood, T. R. E., Henderson, P. A. *Ecological Methods. 4th ed*. Wiley-Blackwell, 2021. 5. Mukhopadhyay, S. C., & Jiang, J.-A. (Eds.). *Wireless Sensor Networks and Ecological Monitoring*. Springer, 2013.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 16.1 International Cooperation in Environmental Protection**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, Associate professor Abduova A.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: Lectures – 30 hours; Practical classes – 30 hours; Current Independent work of students – 55 hours; Midterm Supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 10.1 Current Issues of Geoecology and Landscape Ecology, M 10.2 Rational Use of Natural Resources, M 12.1 Study of Latest Advances in Waste Processing, M 12.2 Modern Methods and Means of Measurements in Ecology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -explain the fundamentals of international environmental law and policy -use economic and financial instruments for environmental protection -create and manage international environmental projects, including planning, coordination, monitoring, and performance evaluation -participate in international negotiations and diplomatic processes for concluding environmental agreements -assess and manage environmental risks in the context of international cooperation and develop adaptation plans -predict economic, social, and environmental consequences of decisions and understand the principles of sustainable development -work in the field of international environmental policy, engage with governmental and private institutions, and contribute to the development and implementation of strategies addressing global environmental challenges
Indicative Content	**Lectures:** Fundamentals of international environmental law and policy. Key international environmental agreements and conventions. Mechanisms for monitoring and compliance with international obligations. Global environmental challenges. International organizations and cooperation mechanisms. UN and specialized agencies. International environmental organizations. Bilateral and multilateral agreements. Economic and financial instruments for environmental protection. Role of science and technology in international cooperation. Technological innovations in environmental management. Research and knowledge exchange. Sustainable Development Goals (SDGs). Evaluation and monitoring of international environmental programs. **Practical classes:** Calculation and management of environmental risks in the context of international cooperation. Development of adaptation plans. Practical skills in participating in international projects. Design and management of international environmental projects, including planning, coordination, monitoring, and performance evaluation. Negotiation and diplomacy. Participation in international negotiations and diplomatic processes aimed at concluding environmental agreements.
Forms of Assessment / Examination	Current assessment: quiz, presentation defense, discussion, case analysis Final assessment: examination

Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Kushkumbaev, S.K. *Kazakhstan and Central Asia between Past Challenges and the Future*. Astana: KISI under the President of the Republic of Kazakhstan, 2022. – 368 p. 2. Bimurzaeva, Z.E. *Environmental Impact Assessment and Ecological Expertise: A Textbook for Students and Master's Students in Life Safety and Ecology*. Karaganda: Medet Group, 2020. – 174 p. 3. Raman, N.S., Gajbhiye, A.R., Khandeshwar, S.R. *Environmental Impact Assessment.* New Delhi: I.K. International Publishing House, 2014. – 216 p. 4. *Environmental Policy in Kazakhstan: Outlines and Prospects: Training Manual.* Nur-Sultan: Konrad Adenauer Stiftung, 2021. – 212 p. 5. Birnie, P., Boyle, A., & Redgwell, C. *International Law and the Environment. 4th ed*. Oxford University Press, 2021.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 16.2 Modern Methods of Remote Sensing in Environmental Research**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Abduova A.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of learners (current) – 55 hours; supervised independent work (midterm) – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 10.1 Current Issues of Geoecology and Landscape Ecology, M 10.2 Rational Use of Natural Resources, M 12.1 Study of Latest Advances in Waste Processing, M 12.2 Modern Methods and Means of Measurements in Ecology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -formulate the basic principles and technologies of remote sensing (RS) and their application in ecology -distinguish between different types of RS data and use them for environmental monitoring -apply spatial modeling methods to study ecosystem changes using RS and GIS data -process and analyze land cover types and the consequences of anthropogenic impacts -independently design and implement ecosystem monitoring projects using RS methods -apply knowledge to develop solutions for improving environmental conditions, assessing ecological impacts, and monitoring natural disasters
Indicative Content	**Lectures:** Fundamentals of remote sensing (RS). Principles and methods of acquiring data via satellites and airborne platforms. Classification of RS data: optical, radar, infrared, hyperspectral. Features and applications of RS in ecology. Satellite monitoring technologies. Key satellite systems. Applications of satellite data for mapping vegetation, water resources, forest fires, and ecosystem changes. Assessment of ecological impacts using RS data. Geographic Information Systems (GIS) in ecology. Modeling ecological processes using RS data. Ecosystem observation and monitoring systems. Technologies for monitoring air, water, and soil

	pollution. Innovations in using unmanned aerial vehicles (drones) for ecological research. **Practical classes:** Working with RS data. Downloading and preprocessing satellite imagery. Using specialized software for data analysis. Land cover classification, vegetation analysis, water bodies, and urban areas. Landscape change analysis. Comparative analysis of satellite images to detect ecosystem changes over time (e.g., deforestation, drought, water level changes). Environmental risk assessment. Using RS data to identify high-risk zones for ecological disasters (fires, floods, pollution). Use of drones. Development of ecological maps. Creation of pollution maps, vegetation maps, and biomass maps using satellite and drone data.
Forms of Assessment / Examination	Current assessment: quiz, presentation defense, discussion, case analysis Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Zhanadilov, A.Yu., & Ibrahimova, L.A. *Modern Problems of Ecology: Textbook.* Almaty: LP-Zhasulan, 2019. – 214 p. 2. Vogelmann, J.E., et al. (2016). *Monitoring vegetation cover with remote sensing and GIS*. Environmental Monitoring and Assessment, 188(3), 1–16. 3. Sullivan, M.P., & Weathers, K.C. (2021). *Modeling and mapping the impacts of land use on species distribution*. Landscape Ecology, 26(9), 1187–1199. 4. Norton, J.P., et al. (2022). *Using GIS to assess vulnerability to climate change*. Climatic Change, 116(3–4), 549–561.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 17.1 Environmental Safety Expertise and Monitoring in Natural Resource Management**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, professor Sagitova G.F.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M 10.1 Current Issues of Geoecology and Landscape Ecology, M 10.2 Rational Use of Natural Resources, M 12.1 Study of Latest Advances in Waste Processing, M 12.2 Modern Methods and Means of Measurements in Ecology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -independently conduct environmental monitoring and ecological expertise -critically evaluate and find solutions for challenges in environmental regulation and pollution reduction -systematically and comprehensively assess negative impacts on the environment -independently evaluate the ecological safety of a specific production process -plan measures for safe and sustainable natural resource management
Indicative Content	**Lectures:** Definition and objectives of environmental monitoring and expertise. General concepts of monitoring and expertise in environmental safety of natural resource management. Scientific foundations of

	environmental monitoring and expertise. Theoretical and methodological principles of ecological expertise. Principles for assessing environmental safety. Modern methods of ecological expertise. Authorized bodies for state environmental expertise. Procedure for conducting state ecological expertise. Documentation submission and review. Expert committee structure and functions. Public ecological expertise. Legal framework for public ecological expertise. **Practical classes:** Monitoring and expertise of air, soil, and water pollution. Methods and tools for environmental monitoring and expertise. Monitoring and assessment of industrial environmental safety. Legal and methodological basis for organizing monitoring and expertise of anthropogenic environmental impacts. International and national programs for environmental safety monitoring and expertise. Legislation of the Republic of Kazakhstan for environmental monitoring and expertise. Assessment of environmental status at industrial facilities. Study of international experience in conducting environmental expertise and monitoring. Sanitary-epidemiological principles of monitoring and expertise. **Laboratory classes:** Determination of heavy metal concentrations and assessment of element mobility. Calculation of accumulation coefficients and geochemical anomalies. Determination of hazard class based on toxicant content. Correlation between morphological composition and toxicity. Modeling sorption and desorption processes of heavy metals. Application of Geographic Information Systems (GIS) and remote sensing (RS) in environmental monitoring.
Forms of Assessment / Examination	Current assessment: quiz, presentation defense, discussion, case analysis Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Kuznetsov, L.M., Shmykov, A.Yu., & Yankovskaya, A.A. *Natural Resource Management and Environmental Safety: Textbook*. Moscow: KnoRus, 2023. – 276 p. ISBN 978-5-406-11281-6 2. Latyshenko, K.P. *Environmental Pollution Monitoring: Textbook and Practical Guide*. 2023. – 369 p. 3. Acevedo, M.F. *Real-Time Environmental Monitoring: Sensors and Systems*. CRC Press, 2nd edition, 2024. ISBN-13: 9781032545714 4. Pandey, P.C., Srivastava, P.K., & Srivastava, S.K. *Aquatic Ecosystems Monitoring: Conventional Assessment to Advanced Remote Sensing*. CRC Press, 2025. ISBN-13: 9781032391120 5. Goodenough, A.E., & Hart, A.G. Applied Ecology: *Monitoring, Managing, and Conserving*. Oxford University Press, 2017. – 413 p. ISBN-13: 9780198723288
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 17.2 Ecosystem Research of Biological Resources**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, professor Sagitova G.F.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total Workload 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS

Prerequisites and Recommended Prior Knowledge	M 10.1 Current Issues of Geoecology and Landscape Ecology, M 10.2 Rational Use of Natural Resources, M 12.1 Study of Latest Advances in Waste Processing, M 12.2 Modern Methods and Means of Measurements in Ecology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -demonstrate skills in ecological analysis of a specific territory -independently conduct ecological monitoring of ecosystem dynamics -apply ecological research methods to solve standard professional tasks -analyze the effects of individual factors on organism development under controlled conditions -carry out short-term monitoring and ecological analysis of available data using the ecosystem-based approach
Indicative Content	**Lectures:** Introduction to the concept of ecosystem research of biological resources. The ecosystem approach as a foundation for ecological studies. Energy flows and material cycling. Establishing functional relationships. Self-regulation concept: contemporary aspects and professional focus. Application of the ecosystem approach in developing strategies for biological resource management. Methodological aspects of ecosystem research. Systems and types of ecosystem studies. Ecological monitoring as a primary method for studying ecosystem (biogeocenosis) dynamics under natural and anthropogenic influences. Historical approach as a tool for ecosystem state forecasting. Identification of long-term ecological trends. **Practical classes:** Linking ecological research with physiological studies. Determining plant resistance to chlorine, sulfur dioxide, and ammonia. Experimental methods: analyzing the effects of individual factors on organism development in controlled conditions. Field studies and experiments using ecosystem approaches, community-level studies (synecology), population-level studies (demecology), habitat analysis, and evolutionary/historical approaches. Application of mathematical methods and modeling in ecological research. **Laboratory classes:** Study methodological foundations of ecosystem research through analysis of structure and functional relationships in biogeocenoses. Apply ecosystem-based approaches to assess status and develop sustainable resource management strategies. Examine systems and classifications of ecosystem research using field and laboratory biodiversity assessment methods. Conduct ecological monitoring of ecosystem dynamics under natural and anthropogenic influences (observations and modeling). Analyze changes in ecosystem composition and structure using long-term monitoring data. Apply historical-ecological approaches to reconstruct ecosystem changes and forecast future states.
Forms of Assessment / Examination	Current assessment: quiz, presentation defense, discussion, case analysis Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Berkinbai, O., Shabdarbayeva, G.S., Khusainov, D.M., Akoev, M.T. *Bioresources of Kazakhstan*. Almanac, 2021. ISBN 978-601-7390-56-3 2. Sukumaran, S.T., & Keerthi, T.R. (Eds.). *Conservation and Sustainable Utilization of Bioresources*. Singapore: Springer Nature, 2023. – 657 p. ISBN 978-981-19-5841-0 3. Weisfeld, L.I., Opalko, A.I., Bome, N.A., Bekuzarova, S.A. (Eds.). *Biological Systems, Biodiversity, and Stability of Plant Communities*. NJ: Apple Academic Press, 2015. – 556 p. ISBN-13: 978-1771880640 4. Larionov, M. *Biodiversity: Status, Ecological-Geographical and Economic Problems of Conservation*. Novosibirsk, 2017. – 278 p. 5. Kanibolotskaya, Y.M., & Toleuzhanova, A.T. *Biological Ecology: Textbook*. S. Toraighyrov Pavlodar State University, 2016. – 60 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 18.1 Environmental Risk Assessment and Management**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Abduova A.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of learners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M 10.1 Current Issues of Geoecology and Landscape Ecology, M 10.2 Rational Use of Natural Resources, M 12.1 Study of Latest Advances in Waste Processing, M 12.2 Modern Methods and Means of Measurements in Ecology
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -assess the acceptability and excessive hazard of activities with potential accidents or environmental impacts based on environmental risk levels -reasonably carry out environmental auditing, expert evaluation, certification, etc., and evaluate environmental hazards and liability for potential damage -manage environmental risks to minimize the "cost" of risk under resource constraints -rank adverse environmental impacts according to actual and predicted hazards; rank territories and population groups based on environmental risk -use the concept of environmental risk as a basis for decision-making in environmental safety, including through legal acts, regulatory, and methodological documents -develop policies for placement and modification of existing enterprises with environmentally hazardous activities, in line with international obligations and procedures
Indicative Content	**Lectures:** Environmental risk concepts. Acceptable environmental risk. Maximum and minimum acceptable risk levels. Individual environmental risk. Background risk. Environmental safety. Environmental impact. Environmental aspects. Quantitative and qualitative evaluation of impacts. Spatial and temporal scales, harmfulness, toxicity, and severity of physical impacts. Excessive environmental hazard. Environmental safety and protection of humans, society, and the environment. **Practical classes:** Risk management. Risk assessment using systems analysis and process modeling. Software and information tools for risk analysis, assessment, and management. Enterprise-level risk management. Determination of environmental damage in physical indicators. Economic assessment of environmental damage. Environmental risk cost. Environmental risk evaluation and analysis procedures.
Forms of Assessment / Examination	Current assessment: group project, graphical calculations of environmental damage, written and oral quizzes Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Bimurzaeva, Z.E. *Environmental Impact Assessment and Ecological Expertise: Textbook for Students and Master's in Ecology*. Karaganda: Medet Group, 2020. – 174 p. 2. Iztileuov, G.M., et al. *Environmental Hazard Assessment: Textbook for 6M060800 "Ecology" Students*. Shymkent: SKSU, 2019. – 108 p.

	3. Raman, N.S., Gajbhiye, A.R., Khandeshwar, S.R. *Environmental Impact Assessment*. New Delhi: I.K. International Publishing House, 2014. – 216 p. 4. Toychibekova, G.B. *Ecological Aspects of Natural Sciences*. Shymkent: Eureka-media LLP, 2017. – 201 p. 5. Ricci, P.F. *Environmental and Health Risk Assessment and Management: Principles and Practices*. Springer, 2006.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 18.2 Biological Diversity of Ecosystems and Urban Systems of the Republic of Kazakhstan**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor Abduova A.A.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total Workload 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of learners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M10.1 Current Problems of Geoecology and Landscape Ecology, M10.2 Rational Use of Natural Resources, M12.1 Study of the Latest Advances in Waste Processing, M12.2 Modern Methods and Tools of Environmental Measurements
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -possess systematic knowledge of the structure, functioning and resilience of ecosystems -apply modern field, laboratory, and remote sensing methods, including GIS technologies, bioindication and mathematical modelling to assess ecosystem and bioresource conditions -evaluate anthropogenic impacts on natural and urban ecosystems -develop environmentally sound recommendations for biodiversity conservation and sustainable natural resource management -apply ecosystem-based and sustainable approaches in professional and research activities
Indicative Content	**Lectures:** Importance of biodiversity for ecosystems. Main ecosystem types and their characteristics (forest, steppe, aquatic, etc.). Structure of ecosystems: biotic and abiotic components. Ecosystems of Kazakhstan: characteristics of steppe, desert, mountain and aquatic systems. Flora and fauna of different ecosystem types. Threats associated with the extinction of rare species and ecosystems. Urban ecosystems and their development. Urbanisation processes and their impact on biodiversity. Influence of cities on climate, flora and fauna. Major ecological problems and threats. Environmental consequences of anthropogenic activities: pollution, land degradation, climate change, biodiversity loss. Conservation and sustainable development: measures for protecting biodiversity and ecosystems. Methods and tools for biodiversity research: bioindication, zoological and botanical surveys, GIS, remote sensing, modern monitoring technologies. **Practical classes:** Field studies of ecosystems (data collection, observation, flora and fauna descriptions). Analysis of urban ecosystems (urbanisation effects, assessments of air, water and soil quality). Development of recommendations for improving urban environmental conditions. Biodiversity monitoring using population accounting methods. Assessment of ecosystem resilience under various conditions. GIS-based biodiversity analysis (mapping of flora and fauna distribution). Modelling

	ecosystem processes and predicting changes under different factors. Preparation of scientific reports and presentations based on field and laboratory research.
Forms of Assessment / Examination	Current assessment: group case analyses, written assignments, written and oral quizzes Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Barton, B., & Lyster, R. (2006). *Environmental Law*. Oxford University Press. 2. The sixth national report on biological diversity in the Republic of Kazakhstan. 3. Issayeva, R. A., et al. (2018). *Influence of Landscape of Urban Territory on Distribution of Pollutants in the Atmosphere*. 120 p. 4. Furumai, H., et al. (2019). *Advanced Monitoring and Numerical Analysis of Coastal Water and Urban Air Environment*. Springer Wien. 156 p. 5. Connecting nature and people: Kazakhstan's path to biodiversity resilience through SPACES initiative. UNDP Kazakhstan.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 19.1 Environmental Standardization, Certification and Licensing**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor A.A. Abduova
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total workload – 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of lerners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M10.1 Current Issues in Geoecology and Landscape Ecology, M10.2 Rational Use of Natural Resources, M12.1 Recent Advances in Waste Processing Technologies, M12.2 Modern Methods and Instruments of Ecological Measurements
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -formulate the fundamentals of environmental standardization and principles of environmental certification -identify major international and national environmental certification systems, such as ISO 14001 (environmental management system), EMAS, Ecolabel, FSC and others -understand the stages of certification procedures, environmental labels and quality marks -conduct internal environmental audits for compliance with ecological standards -develop and implement environmental standards for organisations and enterprises -work with environmental legislation and regulatory acts, including reporting and compliance with environmental requirements
Indicative Content	**Lectures:** Introduction to environmental standardization, certification and licensing. Key terminology: standards, certification, licensing. Role of environmental standardization in sustainable development and environmental protection. Overview of international and national environmental regulatory frameworks. International and national systems

	of environmental certification. Environmental certification in various sectors (agriculture, forestry, industry). Certification procedure: stages, documentation, compliance. Licensing of environmentally significant activities. Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Liability for non-compliance with environmental standards. Current trends and innovations in environmental standardization. **Practical classes:** Working with environmental standards and regulatory documents. Case studies on environmental certification in various sectors. Analysis of ISO 14001 certification process for an enterprise. Preparation of licensing documentation. EIA development for a model project (construction, industrial facility). Preparation and analysis of EIA reports for compliance with ecological requirements. Case studies on certification and licensing failures and prevention measures. Use of eco-labels and quality marks. Preparation of environmental reports. Evaluation of business environmental impact and presentation of findings in compliance with certification requirements.
Forms of Assessment / Examination	Current assessment: group project, written and oral tests Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. ISO 14001:2015. *Environmental management systems — Requirements* with guidance for use. International Organization for Standardization. 2. Daddi, T., Iraldo, F., Testa, F. *Environmental Certification for Organisations and Products: Management Approaches and Operational Tools*. Routledge, 2015. 3. Heras-Saizarbitoria, I. *ISO 9001, ISO 14001, and New Management Standards*. Springer, 2018. 4. Idowu, O., de Vries, J., Mijatovic, I., Choi, D. *Sustainable Development: Knowledge and Education About Standardisation*. Springer, 2020. 5. Beisembayeva, L.K., Tanasheva, M.R., Ponomarenko, O.I. *Ecological Monitoring and Regulation of Environmental Impact*. Almaty: Kazakh University, 2015. ISBN 978-601-04-1120-3.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 19.2 Methodology of Scientific-Creative and Inventive Activities**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, associate professor A.A. Abduova
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Basic discipline, elective component
Teaching and Learning Methods	Lectures, practical classes
Workload (including contact hours and independent study)	Total workload – 150 hours: lectures – 30 hours; practical classes – 30 hours; independent work of lerners (current) – 55 hours; supervised independent work – 35 hours
Number of Credits (ECTS)	5 ECTS
Prerequisites and Recommended Prior Knowledge	M10.1 Current Issues in Geoecology and Landscape Ecology, M10.2 Rational Use of Natural Resources, M12.1 Recent Advances in Waste Processing Technologies, M12.2 Modern Methods and Instruments of Ecological Measurements
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -conduct research and develop innovations, distinguishing scientific inquiry, engineering design, and inventive activity

	-apply idea-generation techniques (brainstorming, six thinking hats, morphological analysis, and others) to solve scientific and technical problems and develop innovative concepts -design and prototype innovative products and technologies using functional analysis, contradiction matrices, 3D modeling, and systems design methods -understand the basics of patent search and the procedure for filing and defending invention applications -comply with scientific ethics, copyright, and academic integrity standards, and assess risks and social consequences of innovations
Indicative Content	**Lectures:** Introduction to the methodology of scientific-creative and inventive activities. Key concepts: scientific creativity, inventive activity, innovation. Role of scientific-creative activity in the progress of science and technology. Distinguishing scientific inquiry from inventive work. Creative process stages. Principles of scientific creativity. Innovation principles. Idea-generation and creativity methods. Methodology of inventive activity. Patent law and intellectual property protection. Innovation processes in science and engineering. Methods for solving inventive problems. Ethics in scientific and inventive work. Problems of plagiarism and intellectual borrowing. Risk assessment and social responsibility. **Practical classes:** Idea-generation exercises using creative techniques. Application of six thinking hats method to evaluate alternative solutions. Use of morphological and focal object methods to find unconventional solutions. Functional analysis and contradiction matrices. 3D modeling and schematics for inventive problem solutions. Prototyping and testing ideas and concepts. Application of creativity methods in scientific research. Patent filing and protection exercises. Design of innovative products using scientific and inventive methods. Preparation of presentations for defending scientific and inventive projects. Peer review and critique of scientific works and inventions. Reporting and evaluating the feasibility of scientific or inventive ideas.
Forms of Assessment / Examination	Current assessment: case studies and project assignments. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Kargin, N.N., Izaak, S.S., Rozhkov, P.P., Ivanus, A.A. *Methodology and Methods of Scientific Research*. INFRA-M, 2024. 2. Iztleuov, G.M. Collection of Lecture Discipline “Environmental Requirements in Economic Activity”: for specialty 6M060800 – Ecology. Shymkent: SKSU, 2024. – 36 p. 3. Aulet, B. Disciplined Entrepreneurship: 24 Steps to a Successful Startup. 2023. 4. Johansson, F. The Medici Effect: *Breakthrough Insights at the Intersection of Ideas, Concepts, and Culture*. 2024. 5. Spektor, M.D. *Methodology and Methods of Scientific Research: Textbook*. Astana: KazATU named after S. Seifullin, 2009. – 485 p. ISBN 978-601-7118-21-1.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 20.1 Environmentally Safe Technologies in Production**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, orofessor Kenzhibaeva G.S.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component

Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total workload – 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M13.1 Green Technologies in Production and Transport, M13.2 Ecological Control and Monitoring of Natural-Technogenic Ecosystems
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -analyze regulatory documents governing the organization of environmental and technological work in production -independently develop plans to monitor compliance with environmental requirements in production -assess the impact of technological processes and facilities on the environment -implement new and improve existing technological processes
Indicative Content	**Lectures:** Challenges and tasks of effective and environmentally safe technologies. Principles of environmentally safe technology design. Industrial catalysis and environmentally safe technologies. Alternative and renewable energy sources. Alternative motor fuels. Biotechnology. Industrial biosynthesis of substances by microorganisms. Biofertilizers. Environmentally safe technologies for waste treatment and disposal. **Practical classes:** Interrelations within the "environment–enterprise" system. Analysis of waste processing technologies. Development and implementation of energy-efficient, zero-waste, and waterless technological processes. Analysis of ecological standards systems. Analysis of resource-saving technologies in industry. **Laboratory classes:** Analysis of municipal solid waste combustion products. Identification of organic compounds using gas chromatography–mass spectrometry. Measurement of aerosol content in ambient air by probing. Determination of iron content using spectrophotometry. Determination of petroleum products in wastewater by fluorimetric analysis. Determination of soil sample moisture by standard and rapid methods. Sample preparation of solid materials for spectral analysis. Measurement of pH of natural waters and soil extracts by potentiometric method.
Forms of Assessment / Examination	Current assessment: case studies and project assignments. Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Isaieva, R.A. Lectures on Environmentally Safe Technologies in Production for 7M05210 – Ecology Master's students. Shymkent: SKU, 2024. – 160 p. 2. Abduova, A.A. *Textbook on Techniques of Environmental Protection for 7M05210 – Ecology Master's students*. Shymkent: SKU, 2024. – 160 p. 3. Rubach, M. *Die Ökobilanz auf dem Teller. Wie wir unserem Essen das Klima schützen können. Stuttgart*: Hirzel Verlag, 2020. – 248 p. 4. Cai, W., Jiang, Z.J., et al. (Eds.) *Green Technologies for Production Processes*. MDPI Books, 2021. 5. Novikov, F.V., Zhovtobriukh, V.A., Novikov, G.V. Modern Environmentally Safe Production Technologies: Monograph. Dnipro: LIRA, 2017. – 372 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 20.2 Water Resources Management**
Semester(s) in which the module is taught	3rd semester

Module Leader / Coordinator	PhD in technical sciences, professor Kenzhibaeva G.S.
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Major course, elective component
Teaching and Learning Methods	Lectures, practical classes, laboratory classes
Workload (including contact hours and independent study)	Total workload – 180 hours: lectures – 30 hours; practical classes – 15 hours; laboratory classes – 30 hours; independent work of learners (current) – 60 hours; supervised independent work – 45 hours
Number of Credits (ECTS)	6 ECTS
Prerequisites and Recommended Prior Knowledge	M13.1 Green Technologies in Production and Transport, M13.2 Ecological Control and Monitoring of Natural-Technogenic Ecosystems
Module Aims and Intended Learning Outcomes	After completing this module, master's student is be able to: -analyze and calculate the permissible anthropogenic load on water bodies -independently develop and analyze water management balances and water resource management schemes for large territories -assess the production function of participants in the water management complex -identify optimal water management solutions based on expert analysis
Indicative Content	**Lectures:** Water resources management system of the Republic of Kazakhstan. Goals, tasks, and structure of water resources management. Key areas of state regulation in water protection and use. Legal framework for water resources management. Economic mechanisms of water management. Ecological aspects of water resources management. **Practical classes:** Water resources and sustainable development. Transition to integrated water resources management. Policies and legislation in water resources management. Basin-based water management. Water resources monitoring. International cooperation and improvement of transboundary water management. Determination of the cost of reproducing ecological potential. Water consumption in low- and zero-water technologies. Calculation of payments for wastewater discharges. Economic efficiency analysis of maximum permissible discharge standards. **Laboratory classes:** Determination of water balance of a territory and its components. Calculation of water consumption and wastewater discharge for enterprises. Laboratory analysis of surface and groundwater quality. Determination of water pollution level using the Water Pollution Index (WPI). Modeling of water runoff using GIS and hydrological models (HEC-RAS, SWAT).
Forms of Assessment / Examination	Current assessment: colloquia, written tests, written and oral surveys Final assessment: examination
Learning and Examination Requirements	During the semester, students must complete all assignments according to the syllabus and obtain 30–60 points for current assessment and 20–40 points for the final examination.
Reading List (Essential and Recommended Literature)	1. Toichibekova, G.B., Abdymutalip, N.A., Kurbaniyazov, S.K. *Monitoring of Aquatic Ecosystems: Textbook*. Shymkent: Eureka-media, 2016. – 200 p. 2. Burlybaev, M.Zh., et al. (Eds.). Problems of Pollution of Major Transboundary Rivers of Kazakhstan, Vol. 2: Basins of the Yesil and Tobol Rivers. Almaty: Kaghanat, 2017. – 552 p. 3. Zauirbek, A.K., Kerimbay, B.S. *Ecological and Economic Principles of Water Use: Educational and Methodical Manual*. Almaty: Evero, 2020. – 136 p. 4. *Hydrology in Water Resources Management*. March 2022. – 284 p. 5. Mahmudova, L.K., Zhakupova, Zh.Z. *Methodology of Scientific Research in Water Resources and Water Use*. Almaty: KazNAIU, 2020. – 135 p.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 21 Master's Student Research Work 3**
Semester(s) in which the module is taught	3rd semester
Module Leader / Coordinator	PhD in technical sciences, professor G.S. Kenzhibaeva PhD in chemical sciences, professor G.M. Iztleuov PhD in technical sciences, associate professor A.A. Abduova PhD in technical sciences, professor G.F. Sagitova PhD, senior lecturer A.N. Tileuberdi PhD in technical sciences, professor R.A. Isaeva PhD in technical sciences, professor Zh.A. Shingisbaeva
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Master's research work
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total workload – 45 hours
Number of Credits (ECTS)	1 ECTS
Prerequisites and Recommended Prior Knowledge	M13.1 Green Technologies in Production and Transport, M13.2 Ecological Control and Monitoring of Natural-Technogenic Ecosystems
Module Aims and Intended Learning Outcomes	After completing the research work in the third trimester, the master's student is able to: -independently conduct scientific research in the field of environmental protection and rational use of natural resources -develop and implement low-waste, waste-free, and resource-saving production technologies in various industrial sectors using industrial waste and substandard raw materials -perform engineering calculations, develop technological schemes, and prepare design data for new low-waste and waste-free productions as part of an authorial team -discuss and critically evaluate the economic significance of fundamental research
Indicative Content	Execution of experimental and research work according to the academic plan using the laboratory equipment of the department and analytical instruments of the university's research laboratories. Application of information technologies and computer programs in completing the master's thesis. Selection and justification of the technological production scheme, calculation of main equipment according to the topic of the master's dissertation. Assessment of the economic efficiency of the developed technology. Formation of conclusions for all sections of the work. Preparation of a research article for publication in scientific journals, conference proceedings, or collections of works by master's and doctoral students. Preparation of the report on the master's research work for the 3rd semester and its defense with a presentation of results.
Forms of Assessment / Examination	Current assessment: published scientific article, results of the master's research work. Final assessment: defense of the research report
Learning and Examination Requirements	During the semester, students must complete assignments according to the individual plan and obtain 30–60 points.
Reading List (Essential and Recommended Literature)	1. QMS SMK PR 7.28-2024. Organization and Conduct of Scientific (Experimental) Research Work of Master's and Doctoral Students. 2. QMS SMK PR 7.29-2024. Organization of Scientific Internships for Master's and Doctoral Students.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 22 Master's Student Research Work 4**

Semester(s) in which the module is taught	4th semester
Module Leader / Coordinator	PhD in technical sciences, professor G.S. Kenzhibaeva PhD in chemical sciences, professor G.M. Iztleuov PhD in technical sciences, associate professor A.A. Abduova PhD in technical sciences, professor G.F. Sagitova PhD, senior lecturer A.N. Tileuberdi PhD in technical sciences, professor R.A. Isaeva PhD in technical sciences, professor Zh.A. Shingisbaeva
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Master's research work
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total workload – 45 hours
Number of Credits (ECTS)	1 ECTS
Prerequisites and Recommended Prior Knowledge	M20.1 Environmentally Safe Technologies in Production, M20.2 Water Resources Management
Module Aims and Intended Learning Outcomes	After completing this course, the master's student will master: -present research results to scientific communities, including preparation and delivery of conference presentations -critically evaluate existing research, analyze its strengths and weaknesses, and develop their own ideas and approaches -prepare scientific publications formatted according to academic standards
Indicative Content	Execution of experimental and research work according to the academic plan using departmental laboratory equipment and analytical instruments of the university's research laboratories. Application of information technologies and computer programs in completing the master's thesis. Selection and justification of the technological production scheme, calculation of main equipment according to the master's dissertation topic. Assessment of the economic efficiency of the developed technology. Formation of conclusions for all sections of the work. Preparation of a research article for publication in scientific journals, conference proceedings, or collections of works by master's and doctoral students. Preparation of the research report for the 4th semester and its defense with a presentation of results. Development of the necessary skills for conducting research in accordance with the dissertation topic. Tasks during the practice include collecting required materials, applying research methods, preparing documentation, and compiling materials for writing the master's dissertation.
Forms of Assessment / Examination	Current assessment: published scientific article, results of the master's research work. Final assessment: defense of the research report
Learning and Examination Requirements	During the semester, students must complete assignments according to the individual plan and obtain 30–60 points
Reading List (Essential and Recommended Literature)	1. QMS SMK PR 7.28-2024. Organization and Conduct of Scientific (Experimental) Research Work of Master's and Doctoral Students. 2. QMS SMK PR 7.29-2024. Organization of Scientific Internships for Master's and Doctoral Students.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.

Module Title	**M 23 Preparation and Defense of the Master's Thesis**
Semester(s) in which the module is taught	4th semester
Module Leader / Coordinator	PhD in technical sciences, professor G.S. Kenzhibaeva PhD in chemical sciences, professor G.M. Iztleuov

	PhD in technical sciences, associate professor A.A. Abduova PhD in technical sciences, professor G.F. Sagitova PhD, senior lecturer A.N. Tileuberdi PhD in technical sciences, professor R.A. Isaeva PhD in technical sciences, professor Zh.A. Shingisbaeva
Language of Instruction	Kazakh, Russian, English
Relation to the Programme / Curriculum Placement	Final assessment of the Master's program
Teaching and Learning Methods	-
Workload (including contact hours and independent study)	Total workload – 240 hours
Number of Credits (ECTS)	8 ECTS
Prerequisites and Recommended Prior Knowledge	M21 Master's Student Research Work 3
Module Aims and Intended Learning Outcomes	After completing this course, the master's student will master: -properly format the master's thesis according to academic standards, including structure, citations, bibliography, and other formal elements -clearly and logically present research results using academic style and appropriate terminology -create and deliver presentations for thesis defense, highlighting key results and conclusions -confidently and competently respond to questions from the thesis committee, justifying conclusions and approaches -prepare scientific articles based on the master's thesis for publication in scholarly journals -critically evaluate their own work, correct errors, and improve the quality of the text before submission -demonstrate confidence during the public defense, effectively communicating the significance and importance of the research -compile a comprehensive report on the research, covering all stages and obtained results
Indicative Content	Final qualification work of the Master's program student, confirming competencies acquired during the program in accordance with the chosen specialization. Defense of the master's thesis at an open session of the Attestation Committee with the participation of the committee chair and at least half of its members. The procedure and regulations for the thesis defense are determined by the committee chair.
Forms of Assessment / Examination	Final assessment – defense of the master's thesis before the Attestation Committee
Learning and Examination Requirements	-
Reading List (Essential and Recommended Literature)	1. QMS SMK P 7.38-2024. Regulations on the Master's Thesis.
Last Revision Date of the Degree Program	Approved by the decision of the Academic Council of the University on 18 March 2025, Protocol No. #4-1.