AL-FARABI KAZAKH NATIONAL UNIVERSITY

EDUCATIONAL PROGRAM IN ENGLISH
HYDROLOGY

Specialty 5B061000-Hydrology

Almaty, 2018

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8) PhD Sairov Serik Biyakhmetovich, director of Almaty department of RSE Kazhydromet;

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PASSPORT
OF EDUCATIONAL PROGRAM IN ENGLISH
«HYDROLOGY»

Passport of the educational program

1. Application area

The present educational program on the specialty "Hydrology" in English is developed on the basis of the Model curriculum of specialty 5B061000-Hydrology (from August 23, 2012 with changes from May 13, 2016) in accordance with international documents in higher education, the recommendations of the ECTS Users' Guide, "Tuning Educational Structures in Europe" and establish the requirements for the content of education through the results of training, the volume of the training load and the level and training of bachelors.

The educational program is developed taking into account the comparison of the laboriousness of the training load in accordance with the requirements of the Bologna Declaration.

2. Normative references

1. The Law of the Kazakhstan Republic "On Education" (No. 319-III from July 27, 2007 in the edition of the Law of the Republic of Kazakhstan from 24.10.11 No. 487-IV, as amended and supplemented as of July 4, 2013);

2. The state general compulsory standard of higher education, approved by the Decree of the Government of the Republic of Kazakhstan from August 23, 2012 No. 1080, as amended from May 13, 2016 No. 292;

3. Typical curriculum on specialty 5B061000-Hydrology approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan from July 5, 2016 No. 425;

4. The National Qualifications Framework, approved by the Protocol of the Republican tripartite commission on social partnership and regulation of social and labor relations from March 16, 2016;

5. The European Credit Transfer and Accumulation System (ECTS) Users' Guide;

6. Documents of the World Meteorological Organization (WMO):

- WMO No. 1083. Manual on the Implementation of Education and Training Standards in Meteorology and Hydrology Volume III. Hydrology. - 2012;

- Guidelines for the education and training of personnel in meteorology and operational hydrology Supplement II: Hydrology Editors: G. Arduino, I. Dragici, M. J. Hall, F. M. Holly Jr., A. Van der Beken. Fourth edition. WMO-No. 258, Switzerland, 2003;

- Guide to Competency. WMO-No. 1205, World Meteorological Organization, 2018, 7 bis, avenue de la Paix – P.O. Box 2300 – CH 1211 Geneva 2 – Switzerland;

- WMO No. 1114. Guidelines for Trainers in Meteorological, Hydrological and Climate. – 2013;

- WMO No. 1160. Manual on the WMO Integrated Global Observing System. – 2015;

- Technical Regulations (WMO No. 49) Volume III: Hydrology World Meteorological Organization 7 bis, avenue de la Paix – P.O. Box 2300 – CH 1211 Geneva 2 – Switzerland;

- WMO-No. 168. Guide to Hydrological Practices Volume I Hydrology – From Measurement to Hydrological Information – Switzerland, - 2011;

- WMO-No. 168. WMO-No. 168. Guide to Hydrological Practices Volume II Hydrology – Management of Water Resources and Application of Hydrological Practices– Switzerland, - 2012.

3. Basic terms and abbreviations

The following main terms and definitions are used in this document in accordance with the Law of the Republic of Kazakhstan "On Education", the state general compulsory standard of the Republic of Kazakhstan "Higher Education. Bachelor's program (Undergraduate). Basic Regulations» No. 292 from May 13, 2016 and the **S**tate General Compulsory Standard of the Republic of Kazakhstan 5.05.001-2005 "The system of coding of higher and post-graduate education subjects", international documents in the field of education, The European Credit Transfer and Accumulation System:

educational program (EP) - a single complex of basic characteristics of education, including the goals, results and content of training, the organization of the learning process, the approaches and methods for their implementation, the criteria for assessing the learning outcomes;

bachelor - higher education, whose educational programs are aimed at training personnel/specialists with the award of a "bachelor" degree in the relevant specialty;

credit - a unified unit of measurement of the volume of scientific and (or) academic work (workload) of the student and (or) lecturer;

credit technology of education - training based on the selection and self-planning by the students of the sequence of studying disciplines with the accumulation of academic credits;

module - autonomous, completed from the point of view of learning outcomes, the structural element of the educational program, which has clearly formulated knowledge, abilities, skills and competencies that are acquired by the trainees, adequate evaluation criteria;

modular educational program - program of training that includes an aggregate of training modules aimed at mastering by students the key competencies required for obtain a certain degree and / or qualification;

modular construction of the educational program – a means of achieving the goal of professional training by determining the content and structure of the educational program on the basis of the concept of the organization of the educational process in which the totality of the professional competencies of the students is the goal of learning;

curriculum - a document regulating the list, consistency, volume (laboriousness) of academic subjects, academic disciplines and (or) modules,

professional practice, other types of educational activities of students of the appropriate level of education and forms of control;

prerequisites - disciplines that contain the knowledge, abilities and skills necessary for mastering of the study of this discipline;

postrequisites - disciplines that require the knowledge, abilities and skills acquired after the completion of the study of this discipline;

regulations for the implementation of the EP - the rules that establish and regulate the organization of the educational process in the implementation of the educational program;

learning outcomes - confirmed by the assessment of the volume of knowledge and skills acquired, demonstrated by students in the development of the educational program, and formed values and relationships.

The learning outcomes is include what the student should know, understand and do at the end of the study period. The activity component is the practical and operational application of knowledge. Learning outcomes are using as a tool for developing a model of training programs [*Walsh A., Webb M. Guide to Writing Learning Outcomes. Learning and Teaching Development Unit. Kingston University, Surrey. 2002];*

the results of mastering the educational program (educational outcomes) - the competences formed in the learner in the course of mastering the EP. The planned results of mastering the educational program at the level of requirements are determined by the educational standard and reflected in the concept of the educational program

a standard curriculum (SC) - a document approved by the authorized authority and regulating the list and amount of core academic disciplines of the specialty, the procedure for their study and forms of control;

elective disciplines are the academic disciplines that are part of the elective component within the established credits and are introduced by educational organizations reflecting the individual training of the trainee, taking into account the specific social-economic development and demands of a specific region, the established scientific schools of the higher educational institution;

The European System of Transfer and Credit Accumulation (ECTS) is a method of assigning credit units to the components of educational programs (disciplines, courses, modules) that compare and retake the students' academic disciplines (with credits and grades) in changing educational trajectory, educational institution and country of instruction.

In addition to it, the following abbreviations apply:

GED - general educational disciplines;

BD - basic disciplines;

PD - profile disciplines;

OC - obligatory component;

EC - elective a component;

IWS – individual work of students;

IWSGL- individual work of students under the guidance of a lecturer.

4. Basic regulations

4.1 Educational activity at the university is carried out by the credit technology of education on the basis of the student-oriented approach, in which the learning outcomes and competence are plays the main role and become the main result of the educational process for the student.

4.2 The educational program on the specialty "Hydrology" was developed in accordance with the State General Educational System of the Republic of Kazakhstan, the National Qualifications Framework and is coordinated with the Dublin descriptors and the European Qualifications Framework. The educational program is focuses on the learning outcomes.

4.3 In the developing process of educational program on the specialty "Hydrology" foreign and domestic experts and department staff are involved.

4.4 Priority areas for developing an educational program on the specialty "Hydrology" are:

- programs, within the framework of the **President's Addresses, including the messages "The Third Modernization of Kazakhstan: Global Competitiveness",** voiced in the text;
- **interdisciplinary programs;**
- **training programs in English language**;
- joint educational programs with foreign partner universities;
- **professional programs by order enterprises-employers**

4.5 The educational program is intended to provide the high quality of professional education in hydrology in accordance with the highest academic standards in the world educational space.

The program has theoretical and practical components. Terms of study: 4 years. Forms of training: full-time. During the period of study, the student learns 162 credits, including theoretical education - 133 credits, professional practice - 18 credits, physical culture - 8 credits and final examination - 3 credits.

The awarded degree for the full mastery of the educational program - Bachelor of Science on the specialty "5B061000-Hydrology".

5. Code and name of the specialty

The code of specialty 5B061000-Hydrology in accordance with the Classifier of specialties of higher and postgraduate education of the Republic of Kazakhstan, this educational program belongs to the section Natural sciences.

In the National Classifier of the Republic of Kazakhstan (NC RK 01-2017 Classifier of lessons), hydrology specialists have the code 2114-3, which is part of the group 2114 Geologists, geophysicists and other specialists in the natural sciences field and are specialists in the science and technology fields.

6. Level of qualification according to the International Standard of Classification of Education

This educational program corresponds to the level of International Standard Classification of Education 6 (ISCED), which do not require the preliminary

completion of other programs and are classify as first-degree programs. The direction of training is bachelor's degree. Duration of training - 4 years.

According to the International Standard Classification of Education (ISCED 2013), this educational program belongs to the Earth sciences, part of the group 44 Physical Sciences from section 4 Science.

7. Objectives of the educational program

The educational program is focuses on the training of highly qualified specialists in the hydrology field, who possess certain knowledge and competencies that are in demand on the labor market.

The objectives of the educational program are:

- Ensure the training of competitive specialists with sufficient knowledge, able to absorb new knowledge objects, as well as generate new knowledge in the hydrology field, formulate production tasks in a professional language and solve those using modern technologies that have an active civil position based on the ideas of peace, goodness and justice.

- acquisition of a complex of knowledge that is the basis of this specialty, skills and abilities to navigate in the flow of information and receive new knowledge for continuing education in the Master's and PhD's program.

8. Field of professional activity of a specialty

The sphere of professional activity of a bachelor on the specialty 5B061000 - Hydrology are:

- The subdivisions of RSE "Kazhydromet" of the Ministry of Energy of the Republic of Kazakhstan;
- LLP Geography Institute of MES RK;
- The subdivisions of the State Institution "Kazmudflow protection" of the Ministry of Internal Affairs of the Republic of Kazakhstan;
- Academic and research institutes associated with the study of hydrosphere and environmental protection;
- Organizations, institutions and enterprises coherent to the assessment of water resources;
- Design, survey, research institutes, offices, firms, etc. various forms of ownership, which depend on the state of water bodies in their activities;
- Organizations, institutions and enterprises associated with the design of dams, reservoirs, shore protectors, regulatory and protective structures and hydraulic structures;
- Environmental protection and nature management agencies;
- Institutions of higher and secondary special education.
- Ministry of Energy;
- Ministry of Agriculture;

Types of economic activity for General Classifier of Economic Activities (GCEA), which graduates of baccalaureate on specialty 5B061000-Hydrology can implement:

01611 Supporting activities in the field of growing of agricultural crops;

01612 Operation of irrigation systems;
36000 Collection, processing and distribution of water;
42910 Construction of water structures;
42212 Construction of pipelines for water supply and sewerage systems;
72190 Other research and experimental development on natural sciences and engineering
74909 Other professional, scientific and technical activities, not elsewhere classified;
74901 Activities of the Hydrometeorological Service;
84250 Activities to ensure safety in emergency situations
85420 Higher education;

9. Directions of professional activity

Graduates on the specialty 5B061000 - Hydrology can perform the following types of professional activities:

- organizational and technological;
- scientific-research;
- operational and production;
- design (survey).

The bachelor's program is formed by the organization depending on the types of educational activity and the requirements for the results of the mastering of an educational program oriented to scientific-research and pedagogical types of professional activity.

10. Competence of a specialist

Bachelor of Natural Science on specialty 5B061000-Hydrology should have general-cultural (GC) and professional (PC) competencies:

Competence Code	Competence Description
GC-1	knowledge of the main stages of the recent history of the progressive development of Kazakhstan's statehood in the context of the global and Eurasian historical process
GC-2	the ability to freely interpret and creatively use scientific, historical and philosophical knowledge to generalize the success factors of the Kazakhstan development model on the way to the country that has taken place - the Republic of Kazakhstan
GC-3	competent use of linguistic and linguocultural knowledge for solving communication problems in the multilingual and multicultural society of the Republic of Kazakhstan and in the international arena
GC-4	knowledge of social and ethical values based on social norms and tolerance to different cultural and confessional traditions
GC-5	knowledge of the basic laws of the functioning and development of nature and society, the ability to adequately navigate in various social-economic, political and emergency situations

GC-6	ability to perceive, analyze, summarize information, goal setting and choose ways to achieve them
GC-7	willingness to cooperate with colleagues, work in a team
GC-8	the ability to apply legal norms and theories in specific practical situations, discern errors and omissions in the logic of reasoning
PC-1	possession of the main aspects of hydrometeorological terminology, nomenclature and professional activity
PC-2	knowledge and understanding of the nature of the basic physical processes taking place in the water bodies of the surface, in close interaction with the environment
PC-3	organization of observations and measurements of elements of the water regime on the hydrological network; knowledge of basic devices; possession of methods for the production and processing of observations of liquid and solid runoff
PC-4	organize a hydrological network of observations; to monitor the quality of the network of hydrological stations and gauging stations
PC-5	knowledge of the chemical composition and hydrochemical regime of atmospheric precipitation, river, lake, reservoir and groundwater
PC-6	possession of methods of chemical analysis of natural waters and hydrochemical studies on water bodies
PC-7	knowledge of basic methods for calculating river runoff; basics of quantitative assessment of changes in river runoff; influence of factors of various economic activities on the runoff
PC-8	to make calculations of separate elements of water balance, and also water balance of various water objects and territories
PC-9	knowledge of the basic laws of static and dynamic water movement in canals, rivers, pipelines.
PC-10	perform calculations of a given channel process with the aim of predicting the expected deformations and taking into account the interaction of engineering structures
PC-11	collect and submit the necessary information for the hydrological justification of projects of hydraulic structures and measures for the use and protection of water bodies, for environmental impact assessment of projects
PC-12	apply existing GIS projects as information support for scientific research; perform automated hydrological calculations in a GIS environment
PC-13	the ability to formulate and practically solve mathematical problems, the most frequent encountered in hydrology, to freely navigate the literature on mathematical methods and information technologies for professional purposes that responding modern requirements

PC-14	hydrological forecasts; methods for assessing the quality of the methodology of hydrological forecasts; methods of short-term and long-term forecasts of elements of the hydrological regime of water bodies
PC-15	the effectiveness of hydrometeorological support of various sectors of the national economy and the study of the principles for selecting optimal solutions based on hydrometeorological information

11. Learning outcomes focused on the Dublin descriptors

By completion of this educational program is expected that students will be able to:

Cognitive competence:

A1. to have an idea of the basic exercises in the field of natural and socio-economic sciences, to analyze socially significant problems and processes, to be able to use the methods of these sciences in various types of professional activity, to have sufficient theoretical training for analyzing the social-economic situation of countries and regions; to realize their professional, social, economic role in society;

A2. know the general laws of the development of nature and society, own a culture of thinking; orient in the ideals and values of a democratic society;

A3. to have an idea of the role of hydrology in related geosciences, the apply of hydrometeorological information in various areas of economic activity of the state.

Functional competencies:

B1. be able to independently acquire new knowledge, use modern information tools and technologies;

B2. use modern methods of assessing the elements of the water balance of water bodies, compose and solve the equations of water, warm and salt balance in the territory of river basins; apply methods of geodetic work and satellite imagery of remote sensing of the territory to solve problems of assessing the morphometric, hydraulic characteristics of watercourses.

B3. to compare the laws of hydrochemical processes occurring in the hydrosphere, to know the modern concepts of the development of hydrochemistry and hydrophysics; have an idea of modern research methods;

B4. apply the basic methods of calculating river flow and be able to use them in the presence of reliable monitoring materials and in their absence;

B5. be able to produce the main types of hydrometeorological observations and works, perform processing of observation materials and prepare them for publication, master modern methods of collecting, processing and analyzing hydrometeorological information;

System Competencies:

C1. to distinguish the basic laws of rest and movement of water in canals, rivers, pipelines, the energy interpretation of processes occurring in open channels

and to own methods of hydraulic calculations for rivers, canals, hydrotechnical and hydrometric structures;

C2. to assess the main characteristics of channel turbulence, the mechanical and hydraulic properties of sediments and bottom sediments, the transport capacity of the turbulent flow;

C3. make hydrological forecasts, justify the methods for determining the pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to design professional information that is presented to both specialists and non-specialists;

Social (communicative) competence:

D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.

12. Accordance of expected learning outcomes to learning methods and assessment in forming competencies

Code and name of competence	Expected results (indicating the generated knowledge and skills)	Module name (with the number of credits)
GC-1 knowledge of the main stages of the recent history of the progressive development of Kazakhstan's statehood in the context of the global and Eurasian historical process	A2. know the general laws of the development of nature and society, own a culture of thinking; orient in the ideals and values of a democratic society; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Module of social and humanitarian – 6 credits Cultural heritage and interpersonal communication module– 5 credits
GC-2 the ability to freely interpret and creatively use scientific, historical and philosophical knowledge to generalize the success factors of the Kazakhstan development model on the way to the country that has taken place - the Republic of Kazakhstan	A1. to have an idea of the basic exercises in the field of natural and socio-economic sciences, to analyze socially significant problems and processes, to be able to use the methods of these sciences in various types of professional activity, to have sufficient theoretical training for analyzing the social-economic situation of countries and regions; to realize their professional, social, economic role in society; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to	Module of social and humanitarian – 6 credits Module of Social-Political Knowledge – 5 credits Cultural heritage and interpersonal communication module– 5 credits

	know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	
GC-3 competent use of linguistic and linguocultural knowledge for solving communication problems in the multilingual and multicultural society of the Republic of Kazakhstan and in the international arena	A1. to have an idea of the basic exercises in the field of natural and socio-economic sciences, to analyze socially significant problems and processes, to be able to use the methods of these sciences in various types of professional activity, to have sufficient theoretical training for analyzing the social-economic situation of countries and regions; to realize their professional, social, economic role in society; A2. know the general laws of the development of nature and society, own a culture of thinking; orient in the ideals and values of a democratic society; B1. be able to independently acquire new knowledge, use modern information tools and technologies; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Instrumental Module – 15 credits Cultural heritage and interpersonal communication module– 5 credits Professional language Module – 4 credits Social-political and historical foundations of modern society module

GC-4 knowledge of social and ethical values based on social norms and tolerance to different cultural and confessional traditions	A2. know the general laws of the development of nature and society, own a culture of thinking; orient in the ideals and values of a democratic society; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Module of social and humanitarian – 6 credits Cultural heritage and interpersonal communication module– 5 credits
GC-5 knowledge of the basic laws of the functioning and development of nature and society, the ability to adequately navigate in various social-economic, political and emergency situations	A1. to have an idea of the basic exercises in the field of natural and socio-economic sciences, to analyze socially significant problems and processes, to be able to use the methods of these sciences in various types of professional activity, to have sufficient theoretical training for analyzing the social-economic situation of countries and regions; to realize their professional, social, economic role in society; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Module of Social-Political Knowledge – 5 credits Ecological Module – 4 credits

GC-6 ability to perceive, analyze, summarize information, goal setting and choose ways to achieve them	A1. to have an idea of the basic exercises in the field of natural and socio-economic sciences, to analyze socially significant problems and processes, to be able to use the methods of these sciences in various types of professional activity, to have sufficient theoretical training for analyzing the social-economic situation of countries and regions; to realize their professional, social, economic role in society; A2. know the general laws of the development of nature and society, own a culture of thinking; orient in the ideals and values of a democratic society;	Module of social and humanitarian – 6 credits Instrumental Module – 15 credits Module of Social-Political Knowledge – 5 credits Cultural heritage and interpersonal communication module– 5 credits
GC-7 willingness to cooperate with colleagues, work in a team	D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Module of social and humanitarian – 6 credits Instrumental Module – 15 credits Module of Social-Political Knowledge – 5 credits Cultural heritage and interpersonal communication module– 5 credits Ecological Module – 4 credits
GC-8 the ability to apply legal norms and theories in specific practical situations, discern errors and omissions in the logic of reasoning	B1. be able to independently acquire new knowledge, use modern information tools and technologies; D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle;	Social-political and historical foundations of modern society module – 4 credits Instrumental Module – 15 credits Professional language Module – 4 credits

	know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	
PC-1 possession of the main aspects of hydrometeorological terminology, nomenclature and professional activity	B4. apply the basic methods of calculating river flow and be able to use them in the presence of reliable monitoring materials and in their absence; B5. be able to produce the main types of hydrometeorological observations and works, perform processing of observation materials and prepare them for publication, master modern methods of collecting, processing and analyzing hydrometeorological information;	Module 1- Means and methods of measurement and calculation of flow characteristics, 12 credits; Module 2 - Global hydrology and hydrology of reservoirs, 6 credits; Module 3 - Hydrometeorological, 9 credits.
PC-2 knowledge and understanding of the nature of the basic physical processes taking place in the water bodies of the surface, in close interaction with the environment	B3. to compare the laws of hydrochemical processes occurring in the hydrosphere, to know the modern concepts of the development of hydrochemistry and hydrophysics; have an idea of modern research methods;	Module 1 - Physical-geographic aspects in hydrology, 4 credits Module 2 - Hydrometeorological, 9 credits; Module 3 - Dangerous hydrological phenomena and hydrology of the seas, 9 credits; Module 4 - Impact of climate change and anthropogenic load on river runoff, 9 credits, Module 5 - Computer technologies in hydrology, 6 credits. Module 6 – Ecological module, 4 credits Module 7 – Mathematical modeling of hydrogeological processes and

		applied issues of hydrology, 9 credits.
PC-3 organization of observations and measurements of elements of the water regime on the hydrological network; knowledge of basic devices; possession of methods for the production and processing of observations of liquid and solid runoff	B5. be able to produce the main types of hydrometeorological observations and works, perform processing of observation materials and prepare them for publication, master modern methods of collecting, processing and analyzing hydrometeorological information	Module 1- Means and methods of measurement and calculation of flow characteristics, 12 credits; Module 2 - Applied Aspects in Hydrology, 6 credits. Module 3 – Mathematical modeling of hydrogeological processes and applied issues of hydrology, 9 credits.
PC-4 organize a hydrological network of observations; to monitor the quality of the network of hydrological stations and gauging stations	A3. to have an idea of the role of hydrology in related geosciences, the apply of hydrometeorological information in various areas of economic activity of the state.	Module 1- Means and methods of measurement and calculation of flow characteristics, 12 credits; Module 2 - Hydrological support of the Economy, 6 credits, Module 3 - Integrated water resources management, 6 credits. Module 4 – Ecological module, 4 credits
PC-5 knowledge of the chemical composition and hydrochemical regime of atmospheric precipitation, river, lake, reservoir and groundwater	B3. to compare the laws of hydrochemical processes occurring in the hydrosphere, to know the modern concepts of the development of hydrochemistry and hydrophysics; have an idea of modern research methods.	Module 1 - Physical-chemical aspects in hydrology, 5 credits; Module 2 - Global hydrology and hydrology of reservoirs, 6 credits.
PC-6 possession of methods of chemical analysis of natural waters and	B3. to compare the laws of hydrochemical processes occurring in the hydrosphere, to know the modern concepts of the development of hydrochemistry and	Module 1 - Physical-chemical aspects in hydrology, 5 credits.

hydrochemical studies on water bodies	hydrophysics; have an idea of modern research methods.	
PC-7 knowledge of basic methods for calculating river runoff; basics of quantitative assessment of changes in river runoff; influence of factors of various economic activities on the runoff	C3. make hydrological forecasts, justify the methods for determining the pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to design professional information that is presented to both specialists and non-specialists.	Module 1 – Calculating and practical aspects in hydrology, 9 credits; Module 2 - Solution of water management issues, 9 credits; Module 3 - Impact of climate change and anthropogenic load on river runoff, 9 credits, Module 4 - Integrated water resources management, 6 credits.
PC-8 To make calculations of separate elements of water balance, and also water balance of various water objects and territories	B2. use modern methods of assessing the elements of the water balance of water bodies, compose and solve the equations of water, warm and salt balance in the territory of river basins; apply methods of geodetic work and satellite imagery of remote sensing of the territory to solve problems of assessing the morphometric, hydraulic characteristics of watercourses.	Module 1 - Applied Aspects in Hydrology, 6 credits; Module 2 - Statistical-mathematical and hydraulic calculations, 6 credits. Module 3 - Computer technologies in hydrology, 6 credits. Module 4 – Mathematical modeling of hydrogeological processes and applied issues of hydrology, 9 credits.
PC-9 knowledge of the basic laws of static and dynamic water movement in canals, rivers, pipelines	C1. to distinguish the basic laws of rest and movement of water in canals, rivers, pipelines, the energy interpretation of processes occurring in open channels and to own methods of hydraulic	Module 1 - Channel Processes, 6 credits; Module 2 - Solution of water management issues, 9 credits;

	calculations for rivers, canals, hydrotechnical and hydrometric structures;	Module 3 - Hydrological support of the Economy, 6 credits; Module 4 - Statistical-mathematical and hydraulic calculations, 6 credits.
PC-10 perform calculations of a given channel process with the aim of predicting the expected deformations and taking into account the interaction of engineering structures	C2. to assess the main characteristics of channel turbulence, the mechanical and hydraulic properties of sediments and bottom sediments, the transport capacity of the turbulent flow	Module 1 - Channel Processes, 6 credits; Module 2 - Solution of water management issues, 9 credits; Module 3 - Statistical-mathematical and hydraulic calculations, 6 credits.
PC-11 collect and submit the necessary information for the hydrological justification of projects of hydraulic structures and measures for the use and protection of water bodies, for environmental impact assessment of projects	D1 to know the legal and ethical norms of the relationship of a person to a person, in general to society, the environment, to be able to use them when organizing their professional activities, to know and observe the norms of a healthy lifestyle; know the traditions and culture of the peoples of Kazakhstan and other nations of the world, own methods of educational and social communication.	Module 1 - Solution of water management issues, 9 credits; Module 2 - Hydrological support of the Economy, 6 credits; Module 3 - Ecological, 4 credits; Module 4 - Integrated water resources management, 6 credits.
PC-12 use existing GIS projects as information support for scientific research; Perform automated hydrological calculations in a GIS environment	B1. be able to independently acquire new knowledge, use modern information tools and technologies;	Module 1 - GIS technology in hydrology, 6 credits; Module 2 – Calculating and practical aspects in hydrology, 9 credits; Module 3 - Computer technologies in hydrology, 6 credits.

		Module 4 – Mathematical modeling of hydrogeological processes and applied issues of hydrology, 9 credits.
PC-13 the ability to formulate and practically solve mathematical problems, most often encountered in hydrology, to freely navigate the literature on mathematical methods and information technologies for professional purposes that responding modern requirements	C3. make hydrological forecasts, justify the methods for determining the pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to design professional information that is presented to both specialists and non-specialists; B4. apply the basic methods of calculating river flow and be able to use them in the presence of reliable monitoring materials and in their absence.	Module 1 - STEM-module, 6 credits; Module 2 – Calculating and practical aspects in hydrology, 9 credits. Module 3 - GIS technology in hydrology, 6 credits. Module 4 - Computer technologies in hydrology, 6 credits. Module 5 – Instrumental module, 15 credits. Module 6 – Mathematical modeling of hydrogeological processes and applied issues of hydrology, 9 credits.
PC-14 hydrological forecasts; methods for assessing the quality of the methodology of hydrological forecasts; methods of short-term and long-term forecasts of elements of the hydrological regime of water bodies	B4. apply the basic methods of calculating river flow and be able to use them in the presence of reliable monitoring materials and in their absence;	Module 1 – Calculating and practical aspects in hydrology, 9 credits; Module 2- Statistical-mathematical and hydraulic calculations, 6 credits

PC-15 the effectiveness of hydrometeorological support of various sectors of the national economy and the study of the principles for selecting optimal solutions based on hydrometeorological information	B5. be able to produce the main types of hydrometeorological observations and works, perform processing of observation materials and prepare them for publication, master modern methods of collecting, processing and analyzing hydrometeorological information;	Module 1 – Calculating and practical aspects in hydrology, 9 credits; Module 2 - Hydrological support of the Economy, 6 credits, Module 3 - Integrated water resources management, 6 credits.

Matrix of formation of competencies on the modules of the Educational program

Module name	Learning outcomes											
	A1	A2	A3	B1	B2	B3	B4	B5	C1	C2	C3	D1
Module of social and humanitarian	■	■										■
Instrumental Module	■		■	■								■
Module of Social-Political Knowledge	■	■										■
Cultural heritage and interpersonal communication module	■	■										■
Ecological Module		■	■									■
Social-political and historical foundations of modern society module		■										■
Professional language Module	■	■										■
Module Hydrometeorological						■	■	■				
Module Means and methods of measurement and calculation of flow characteristics			■				■	■				
STEM-module							■				■	
Module Physical-geographic aspects in hydrology						■						
Module Physical-chemical aspects in hydrology						■						
Module Applied Aspects in Hydrology					■			■				
Module Calculating and practical aspects in hydrology				■			■	■			■	
Module Solution of water management issues									■	■	■	■
Module Global hydrology and hydrology of reservoirs						■	■	■				
Module Statistical-mathematical and hydraulic calculations					■		■		■	■		
Module Channel Processes									■	■		
Module GIS technology in hydrology				■								
Module Hydrological support of the Economy			■					■	■			■
Module Dangerous hydrological phenomena and hydrology of the seas						■						

Module Computer technologies in hydrology												
Module Integrated water resources management												
Module Impact of climate change and anthropogenic load on river runoff												
Mathematical modeling of hydrogeological processes and applied issues of hydrology												
Module of professional practice												

13. Curriculum of «5B061000-Hydrology» specialty

Code	Name of disciplines / types of academic work	Credits	ECTS	Semesters																							
				I			II			III			IV			V			VI			VII			VIII		
				Lectures+practice/seminar+laboratory																							
GENERAL EDUCATIONAL DISCIPLINES		**30**	**50**	**9**			**9**			**5**			**7**			**0**			**0**			**0**			**0**		
OBLIGATORY COMPONENT		**21**	**35**	**9**			**9**			**0**			**3**			**0**			**0**			**0**			**0**		
	Module of social and humanitarian	**6**	**10**	**3**			**0**			**0**			**3**			**0**			**0**			**0**			**0**		
MHK1101	Modern history of Kazakhstan	3	5	2	1	0																					
Phil2102	Philosophy	3	5										2	1	0												
	Instrumental Module	**15**	**25**	**6**			**9**			**0**			**0**			**0**			**0**			**0**			**0**		
FL1103	Foreign Language	6	10	0	3	0	0	3	0																		
K(R)L1104	Kazakh (Russian) Language	6	10	0	3	0	0	3	0																		
ICT1105	Information and Communication Technologies	3	5				2	0	1																		
ELECTIVE COMPONENT		**9**	**15**	**0**			**0**			**5**			**4**			**0**			**0**			**0**			**0**		
	Module of Social-Political Knowledge	**5**	**9**	**0**			**0**			**3**			**2**			**0**			**0**			**0**			**0**		
Soc2106	Sociology	3	5							2	1	0															
Pol2107	Political Science	2	4										1	1	0												
	Cultural heritage and interpersonal communication module	**5**	**9**	**0**			**0**			**3**			**2**			**0**			**0**			**0**			**0**		
Cul2106	Culturology	3	5							2	1	0															
Psy2107	Psychology	2	4										1	1	0												
	Ecological Module	**4**	**6**	**0**			**0**			**2**			**2**			**0**			**0**			**0**			**0**		
ESD2108	Ecology and sustainable development	2	4										1	1	0												
HLS2109	Human Life Safety	2	4							1	1	0															
	Social-political and historical foundations of modern society module	**4**	**6**	**0**			**0**			**2**			**2**			**0**			**0**			**0**			**0**		
SRFHC2108	Spiritual revival and the formation of historical consciousness	2	4										1	1	0												

SChPM2109	Social change and political modernization	2	4							1	1	0																	
BASIC DISCIPLINES		**70**	**120**	**12**			**10**			**13**			**11**			**9**			**9**			**6**			**0**				
OBLIGATORY COMPONENT		**25**	**43**	**6**			**3**			**5**			**5**			**3**			**3**										
	Professional language Module	**4**	**8**	**0**			**0**			**2**			**2**			**0**			**0**			**0**			**0**				
PK(R)L2201	Professional Kazakh (Russian) Language	**2**	**4**							0	2	0																	
POFL2202	Professionally-oriented Foreign Language	**2**	**4**										0	2	0														
	Module Hydrometeorological	**9**	**15**	6			3																						
GM1203	General meteorology	**3**	**5**	2	0	1																							
FH1204	Fundamentals of hydrology	**3**	**5**	2	0	1																							
HR1205	Hydrology of rivers	**3**	**5**				2	0	1																				
	Module Means and methods of measurement and calculation of flow characteristics	**12**	**20**	0			0			3			3			3			3			0			0				
Hyd2206	Hydrometry	**6**	**10**							2	0	1	2	0	1														
HC3207	Hydrological calculation	**6**	**10**													2	0	1	2	0	1								
ELECTIVE COMPONENT		**45**	**77**	6			7			8			6			6			6			6							
	STEM-module	**6**	**10**	**6**			**0**			**0**			**0**			**0**			**0**			**0**			**0**				
HM1208	Higher Mathematics	**3**	**5**	2	0	1																							
Phys1209	Physics	**3**	**5**	2	0	1																							
	Module Physical-geographic aspects in hydrology	**4**	**8**	**0**			**4**			**0**			**0**			**0**			**0**			**0**			**0**				
PESGK 1210	Physical, economic and social geography Kazakhstan	**2**	**4**				1	1	0																				
GC1211	Geodesy and Cartography	**2**	**4**				1	0	1																				
	Module Physical-chemical aspects in hydrology	**5**	**9**	**0**			**0**			**5**			**0**			**0**			**0**			**0**			**0**				
HPh2212	Hydrophysics	**3**	**5**							2	0	1																	
HC2213	Hydrochemistry	**2**	**4**							1	0	1																	
	Module Applied Aspects in Hydrology	**6**	**10**	**0**			**0**			**0**			**3**			**3**			**0**			**0**			**0**				
WBS2214	Water-balance studies	**3**	**5**										2	0	1														

HFS3215	Hydrological field survey	**3**	**5**													2	0	1											
	Module Calculating and practical aspects in hydrology	**9**	**15**	**0**			**0**			**0**			**0**			**0**			**6**			**3**			**0**			
HF3216	Hydrological forecasts	**6**	**10**																2	0	1	2	0	1				
AUHC3217	Assessment of uncertainty in hydrological calculation	**3**	**5**																2	0	1							
	Module Solution of water management issues	**9**	**15**	**0**			**0**			**0**			**3**			**3**			**0**			**3**			**0**			
HELR2218	Hydraulic engineering and land reclamation	**3**	**5**										2	0	1													
EWRM3219	Economics of water resources management	**3**	**5**													2	0	1											
AAIWR4220	Assessment of anthropogenic impacts on water runoff	**3**	**5**																			2	0	1				
	Module Global hydrology and hydrology of reservoirs	**6**	**10**	**0**			**3**			**3**			**0**			**0**			**0**			**0**			**0**			
RBW1221	River basins of the world	**3**	**5**				2	1	0																			
HLR2222	Hydrology of lakes and reservoir	**3**	**5**							2	0	1																
PROFILE DISCIPLINES		**33**	**55**	0			0			0			3			9			9			12			0			
OBLIGATORY COMPONENT		**6**	**10**	0			0			0			0			6			0			0			0			
	Module Statistical-mathematical and hydraulic calculations	**6**	**10**	0			0			0			0			6			0			0			0			
GRH3223	General and river hydraulics	**3**	**5**													2	0	1										
MMSPHI3224	Modern methods of statistical processing of hydrological information	**3**	**5**													2	0	1										
ELECTIVE COMPONENT		**27**	**45**	**0**			**0**			**0**			**3**			**3**			**9**			**12**			**0**			
	Module Channel Processes	**6**	**10**	**0**			**0**			**0**			**0**			**3**			**3**			**0**			**0**			
DChF3225	Dynamics of channel flow	**3**	**5**													2	0	1										
ChP3226	Channel processes	**3**	**5**																2	0	1							
	Module GIS technology in hydrology	**6**	**10**	**0**			**0**			**0**			**0**			**0**			**3**			**3**			**0**			
GISH3228	GIS in Hydrology	**3**	**5**																2	0	1							
MHPGIS4227	Modeling of hydrological processes in GIS	**3**	**5**																			2	0	1				

	Module Hydrological support of the Economy	**6**	**10**	**0**			**0**			**0**			**0**			**0**			**0**			**6**			**0**		
HSWC4229	Hydrological services for the water consumers	**3**	**5**																			2	1	0			
WASSWT4230	Water abstraction supply, sanitation and wastewater treatment	**3**	**5**																			2	0	1			
	Module Dangerous hydrological phenomena and hydrology of the seas	**9**	**15**	**0**			**0**			**0**			**3**			**0**			**3**			**3**			**0**		
WRNH3231	Water-related natural hazard	**3**	**5**																2	0	1						
IMP4232	Introduction to mudflow processes	**3**	**5**																			2	0	1			
HSER2233	Hydrology of the seas and estuaries of rivers	**3**	**5**										2	0	1												
	Module Computer technologies in hydrology	**6**	**10**	**0**			**0**			**0**			**0**			**0**			**3**			**3**			**0**		
HM4227	Hydrological modeling	**3**	**5**																			2	0	1			
HPCS3228	Hydrodynamic processes of the Caspian Sea	**3**	**5**																2	0	1						
	Module Integrated water resources management	**6**	**10**	**0**			**0**			**0**			**0**			**0**			**0**			**6**			**0**		
IRBME4229	Integrated River basin management and Ecohydrology	**3**	**5**																			2	1	0			
GARBM4230	Geomorphological approach to river basin management	**3**	**5**																			2	0	1			
	Module Impact of climate change and anthropogenic load on river runoff	**9**	**15**	**0**			**0**			**0**			**3**			**0**			**3**			**3**			**0**		
RSGEC3231	River system and global environmental change	**3**	**5**																2	0	1						
ECCWM4232	Effects of climate change on watershed management	**3**	**5**																			2	0	1			
PPMTRK2233	Problem of pollutions of the main transboundary rivers of Kazakhstan	**3**	**5**										2	0	1												
	Mathematical modeling of hydrogeological processes and applied issues of hydrology	**9**	**15**	**0**			**0**			**0**			**3**			**0**			**3**			**3**			**0**		
UH3231	Urban hydrology	**3**	**5**																2	0	1						

MMGFT4232	Mathematical modeling of the groundwater flow and transport	**3**	**5**																			2	0	1			
HP2233	Hydrological processes	**3**	**5**										2	0	1												
	Total theoretical education	**133**	**225**	**21**			**19**			**18**			**21**			**18**			**18**			**18**			**0**		
ADDITIONAL TYPES OF TRAINING (ATT)		**26**	**44**	**2**			**4**			**2**			**10**			**0**			**2**			**0**			**6**		
	Module of Physical training	**8**	**14**	**2**			**2**			**2**			**2**			**0**			**0**			**0**			**0**		
PhT	Physical Training	**8**	**14**	0	0	2	0	0	2	0	0	2	0	0	2												
	Module of professional practice	**18**	**30**	0			2			0			8			0			2			0			6		
TP	Training practice	**10**	**17**				2 (1 week)						8 (4 week)														
IP	Industry practice	**5**	**8**																2 (5 week)						3 (7,5 week)		
UGP	Undergraduate practice (work on the preparation of the diploma)	**3**	**5**																						3 (7,5 week)		
FINAL EXAMINATION		**3**	**5**	0			0			0			0			0			0			0			3		
SES	State exam in the specialty	**1**	**2**																						1 (2 week)		
WDW	Writing and defense of the diploma work (project)	**2**	**3**																						2 (4 week)		
TOTAL		**162**	**274**	**23**			**23**			**20**			**28**			**18**			**20**			**18**			**9**		

14. The innovation of the educational program

The educational program Hydrology in English is includes the following elements of innovation:

✓ EP is formed on the basis of international experience in training specialists in the hydrology field – the surface water direction;

✓ The structure, content, modules and disciplines of the EP are prepared jointly with the main employers and developers of the EP from the number of famous scientists and educators from Europe countries (Germany, Spain, UK, Finland), Russia and Kazakhstan;

✓ The content of basic disciplines taught at Western European universities to hydrologists students in the surface land waters direction, and alternative courses are include additions taking into account modern methods of monitoring elements of the water regime and runoff characteristics, modeling of hydrological processes and methods of forecasting them;

✓ EP contains 10 new alternative courses:

- Hydrological modeling (Abror Gafurov, Germany)
- Hydrodynamic processes of the Caspian Sea (Ivkina N.I. RSE «Kazhydromet»)
- Integrated River basin management and Ecohydrology (Nicola Fohrer, Germany)
- Geomorphological approach to river basin management (Mark G. Macklin, UK)
- River system and global environmental change (Mark G. Macklin, UK)
- Effects of climate change on watershed management (Manuel Pulido, Spain)
- Problem of pollutions of the main transboundary rivers of Kazakhstan (Burlibayev M. Zh. «Kazakhstan Agency of Applied Ecology»)
- Urban hydrology (Bjorn Klove, Finland)
- Mathematical modeling of the groundwater flow and transport (Jose E. Capilla, Spain)
- Hydrological processes (Bjorn Klove, Finland).

New specializations:

- modern and perspective methods of ground and satellite monitoring of water bodies;
- the use of GIS technology in solving hydrological problems;
- modeling of hydrological processes based on computer technologies;
- mathematical modeling of runoff and groundwater transport;
- management of water resources and the ecological state of natural waters;
- chemical runoff of rivers.

✓ Programs of educational and industrial practices are developed taking into account innovations in the production activities of organizations and scientific institutes. EP supplemented with geodetic educational practice necessary as part of the course for the mastering of modern skills of geodesic and cartographic works.

✓ EP includes a module that depends on the requirements, relevance, requests of employers and can vary economic tasks of the republic.

- ✓ EP is focused on participation in the educational process of scientists and educators of foreign countries who have their courses in the present EP, which will expand the professional opportunities of graduates and adapt to the world professional environment of hydrological specialists.

CONTENT OF EDUCATIONAL MODULES OF DISCIPLINES

GENERAL EDUCATIONAL DISCIPLINES (GED) – 30 credits

OBLIGATORY COMPONENT (OC) – 21 credits

Module of social and humanitarian – 6 credits

As a result of studying the module, student able to:

- know the main stages of the modern history of development of Kazakhstan, as well as the history of its economic development
- take into account the cultural values and traditions of Kazakhstan in their professional activities
- to analyze the judgments of a critical nature to the study of diverse social-political and economic phenomena of modernity
- apply knowledge in analyzing the realities of the social-political and economic life of society
- operate with special philosophical terminology and the categorical-conceptual apparatus of philosophy
- logically express their thoughts on the studied philosophical issues
- to compare and reasonably defend their own ideological position on various problems of philosophy
- be able to freely interpret and creatively use scientific, historical and philosophical knowledge to analyze the factors of development of the Kazakhstan model of society and the economy.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: colloquium, exam;

2) written work: test, essay;

3) control with the help of technical means and information systems: computer testing programs, complex situational tasks; exam testing;

4) innovative assessment tools: evaluation of solution cases, Delphi's method (brain attack).

MHK1101 Modern history of Kazakhstan - 3 credits

Prerequisites: no.

Postrequisites: no.

As a result of studying the discipline, the student is able to:

- demonstrate knowledge of the main periods of the formation of an independent Kazakhstan statehood;
- to correlate the phenomena and events of the historical past with the general paradigm of the world-historical development of human society through critical analysis;
- mastering the techniques of historical description and analysis of the causes and consequences of the events of the modern history of Kazakhstan;

- propose possible solutions to contemporary problems based on an analysis of the historical past and reasoned information;

- analyze the features and significance of the modern Kazakhstan model of development;

- to determine the practical potential of intercultural dialogue and respect for spiritual heritage;

- to substantiate the fundamental role of historical knowledge in the formation of Kazakhstan's identity and patriotism;

- to form own civil position on the priorities of mutual understanding, tolerance and democratic values of modern society.

Studying topics:

1. Conceptual framework for the study of national history.

2. Prerequisites for the formation of independence in Kazakhstan: national liberation uprisings and the formation of the idea of a national state.

3. The process of polarization of political forces.

4. Civil and political confrontation.

5. Implementation of the Soviet model of nation-building.

6. Contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the twentieth century.

7. The policy of "restructuring" of Kazakhstan.

8. Formation of the state structure of the Republic of Kazakhstan.

9. Kazakhstan model of economic development.

10. Social modernization - the basis of the welfare of society.

11. Ethno-demographic processes and the strengthening of interethnic harmony.

12. Socio-political development prospects and spiritual modernization.

13. The policy of forming a new historical consciousness and worldview of the people of the Great Steppe.

14. Kazakhstan is a state recognized by the modern world.

15. N.A. Nazarbayev - a person in history. Formation of a united nation of the future.

Phil2102 Philosophy - 3 credits

Prerequisites: MHK1101 Modern history of Kazakhstan.

Postrequisites: no.

As a result of studying the discipline, the student is able to:

- explain the specifics of the philosophical understanding of reality;

- justify the worldview as a product of philosophical reflection and study of the natural and social world;

- classify the methods of scientific and philosophical knowledge of the world;

- Interpret the content and specific features of the mythological, religious and scientific worldview;

- to substantiate the role and importance of key ideological concepts as values of the social and personal being of a person in the modern world;

- analyze the philosophical aspect of media texts, socio-cultural and personal situations to substantiate and make ethical decisions;

- to formulate and correctly argue their own moral position in relation to the actual problems of modern global society;

- conduct research that is relevant to identify the philosophical content of problems in the professional field and present the results for discussion.

Studying topics:

1. The emergence and development of philosophy. The subject and method of philosophy.
2. Historical types of philosophy.
3. Basic philosophical understanding of the world.
4. The problem of being. Ontology and metaphysics.
5. Consciousness and language.
6. Cognition and creativity.
7. Scientific and extra-scientific knowledge. Science and technology.
8. Philosophy of man and value world.
9. Human. Life and death. Meaning of life.
10. Ethics. The philosophy of values.
11. Freedom.
12. Aesthetics. Perception and creation of beauty.
13. Society and culture.
14. Philosophy of history.
15. «Magilik Yel» and «Ruhanizakyru» - the philosophy of the new Kazakhstan.

Instrumental Module – 15 credits

As a result of studying the module, student able to:

- know the orthoepic, orthographic, stylistic norms of the Russian / Kazakh / foreign languages;
- master the features of professional oral and written scientific speech;
- explain the technology of interpretation and analysis of the texts of scientific literature in the specialty;
- have an understanding of the role and importance of information and information technology in the development of modern society and the economy of knowledge in English;
- possess the basic methods, methods and means of obtaining, storing, processing information,
- have computer skills as an information management tool;
- be able to work with information in global computer networks and corporate computer systems in English;
- competently use linguistic and cultural linguistic knowledge for communication in a multilingual and multicultural society of the Republic of Kazakhstan and in the international arena.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: colloquium, exam;

2) written work: test, essay, laboratory and settlement and graphic work;

3) control with the help of technical means and information systems: computer testing programs, virtual laboratory work, exam testing, educational tasks on specialized programs;

4) innovative assessment tools: situation tasks, portfolio, method of developing cooperation (group problem solving with the distribution of roles).

FL1103 Foreign language –6 credits

Prerequisites: no.

Postrequisites: POFL2202 Professionally-oriented Foreign Language.

As a result of studying the discipline, the student is able to:

- reproduce orthoepic, spelling, stylistic norms of Russian / Kazakh / foreign languages;
- use the features of professional oral and written scientific speech;
- apply the technology of interpretation and analysis of the texts of scientific literature in the specialty;
- have an idea of the role and importance of information and information technology in the development of modern society and the economy of knowledge in the English language;
- practice the main methods, methods and means of obtaining, storing, processing information;
- have computer skills as an information management tool;

- to build work with information in the global computer networks and corporate computer systems in English;

- competently use linguistic and cultural linguistic knowledge for communication in a multilingual and multicultural society of the Republic of Kazakhstan and in the international arena.

K(R)L1104 Kazakh (Russian) Language –6 credits

Prerequisites: no.

Postrequisites: PK (R) L2201 Professional Kazakh (Russian) language.

As a result of studying the discipline, the student is able to:

- to make the right choice and use of language and speech means on the basis of knowledge of a sufficient amount of vocabulary, system of grammatical knowledge, pragmatic means of expressing intentions;

- transfer the factual content of texts, formulate their conceptual information, describe output knowledge (pragmatic focus) of the entire text, as well as of its individual structural elements;

- interpret the information of the text, explain in the volume of certification requirements the style and genre specificity of the texts of the socio-cultural, socio-political, official business and professional areas of communication;

- request and report information in accordance with the situation of communication, evaluate actions and actions of participants, use information as a tool to influence an interlocutor in situations of knowledge and communication in accordance with certification requirements;

- to build programs of speech behavior in situations of personal, social and professional communication in accordance with the norms of language, culture, the specifics of the sphere of communication, certification requirements;

- to discuss ethical, cultural, socially significant problems in the discussions, to express their point of view, to defend it reasonably, to critically evaluate the opinion of interlocutors;

- participate in communication in various situations of different areas of communication in order to realize their own intentions and needs (everyday, educational, social, cultural), declaring about them ethically correctly, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation;

- compile household, socio-cultural, and official business texts in accordance with generally accepted standards and functional orientation, using adequate lexical-grammatical and pragmatic material of a certain certification level, which is adequate for the purpose set.

Studying topics:

1. The content of the educational program level A1.
2. The content of the educational program level A2.
3. The content of the educational program level B1.
4. The content of the educational program level B2 + LSP.
5. The content of the educational program of level C1.

6. The content of the educational program of the level - CALP –cognitive academic proficiency in the language.

ICT1105 Information and Communication Technologies - 3 credits

Prerequisites: no

Postrequisites: MMSPHI3224 Modern methods of statistical processing of hydrological information, GISH3228 GIS in Hydrology, MHPGIS4227 Modeling of hydrological processes in GIS.

As a result of studying the discipline, the student is able to:

- explain the purpose, content and development trends of information and communication technologies, justify the choice of the most appropriate technology to solve specific problems;
- explain the methods of collecting, storing and processing information, how to implement information and communication processes;
- describe the architecture of computer systems and networks, the purpose and functions of the main components;
- use information Internet resources, cloud and mobile services for searching, storing, processing and distributing information;
- use software and hardware of computer systems and networks for collecting, transmitting, processing and storing data;
- analyze and justify the choice of methods and means of protecting information;
- using digital technologies to develop data analysis and data management tools for various activities;
- to carry out project activities in the specialty with the use of modern information and communication technologies.

Studying topics:

1. The role of ICT in key sectors of social development. ICT standards.
2. Introduction to computer systems. Computer systems architecture.
3. Software. Operating Systems.
4. Human-computer interaction.
5. Database systems.
6. Data analysis. Data management.
7. Networks and telecommunications.
8. Cybersecurity.
9. Internet technology.
10. Cloud and mobile technologies.
11. Multimedia technology.
12. Smart technology.
13. E-technology. E-business. E-learning. E-government.
14. Information technology in the professional field. Industrial ICT.
15. Prospects for ICT development

ELECTIVE COMPONENT – 9 credits

Module of Social-Political Knowledge – 5 credits

As a result of studying the module, student able to:

- to distinguish between the terminological apparatus and the main provisions of theoretical and applied political science;
- to use the acquired knowledge and skills in the study of professional disciplines, in practical professional activities;
- know the basic concepts and categories, fundamental concepts and techniques of general and applied sociology;
- apply their knowledge and skills in the study of professional disciplines, in practical professional activities, in conducting sociological research;
- develop a program of sociological (marketing) research, tools, analyze the results;
- perform analytical and organizational work in the preparation of concepts, plans, schedules and implementation of advertising campaigns;
- use the technology of sociological research;
- apply the technology of marketing research.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: colloquium, exam;

2) written work: test, essay;

3) control with the help of technical means and information systems: computer testing programs, educational tasks on specialized programs;

4) innovative assessment tools: case-method, portfolio, business (role-playing) game, debate, discussion, project method, incident method, method of successive situations, etc.

Soc2106 Sociology – 3 credits

Prerequisites: MHK1101 Modern history of Kazakhstan

Postrequisites: Psy2107 Psychology

As a result of studying the discipline, the student is able to:

- to determine the objects of the study of sociology (society, social organizations, social groups, individuals, etc.) to explain the social reality;

Explain key sociological ideas and theories;

- describe the social structure and stratification of society, distinguish and analyze the degree of social inequality;

To reveal the mechanism of formation of public opinion and consciousness in society;

- analyze the characteristics of social institutions in the modernization of Kazakhstani society;
- understand the interaction of social processes at the micro and macro levels, taking advantage of the sociological perspective;

- distinguish and justify the strategy of sociological research and methods of collecting and analyzing information;

- apply a sociological methodology to the study of contemporary problems of society.

Studying topics:

1. Sociology in understanding the social world.
2. Introduction to sociological theory.
3. Social structure and stratification.
4. Socialization and identity.
5. Mass media, technology and society.
6. Sociology of ethnicity and nation.
7. Religion, culture and society.
8. Education and social inequality.
9. Family and modernity.
10. Deviation, crime and social control.
11. Economy, globalization and labor.
12. Health and medicine.
13. Population, urbanization and social movements.
14. Sociological research.
15. Social change: the latest sociological debate.

Pol2107 Political Science – 2 credits

Prerequisites: no

Postrequisites: no

As a result of studying the discipline, the student is able to:

- describe the features of the organization and functioning of political institutions (institutions of representation and coordination of interests);

- demonstrate an understanding of the mechanisms and principles of the functioning of political power, political institutions, domestic, foreign, world politics and international relations;

- demonstrate an understanding of the nature and laws of the functioning and development of politics, its role in various spheres of society;

- justify the relationship of political systems and political regimes;

- to assess the degree of objectivity of political information from various sources, to argue with conviction to express their citizenship, to evaluate facts, events, phenomena based on the analysis of the political strategy and national interests of modern states;

- justify the leading role of identity (national, civil) as a factor in ensuring the national security of the Republic of Kazakhstan;

- Identify the nature of sociopolitical conflicts and assess their legitimacy;

- generate new ideas and apply to a changing political reality.

Topics covered:

1. Politics in the structure of public life.
2. Power as a political institution.

3. Subjects of policy.

4. The rule of law and civil society.

5. The specificity of political parties, party systems and socio-political movements and organizations.

6. Political systems of the present.

7. Political regimes in modern political science.

8. Political culture and behavior.

9. Political ideology and national consciousness.

10. National interests and national security.

11. Political development and modernization.

12. Conflict and crisis situations in politics.

13. World politics and modern international relations.

14. Sovereign Kazakhstan in the system of international relations.

15. The third modernization in the Republic of Kazakhstan.

Cultural heritage and interpersonal communication module– 5 credits

As a result of studying the module, student able to:

- demonstrate knowledge of the norms of the modern literary language, comprehend the process of normalization of the language and the tendency of the development of the norm, be able to use the communicative qualities of Russian speech;

- be able to speak publicly in various genres of modern oratory, correctly use the normative potential of the language, own the culture of the dispute;

- understand the main interrelations of the culture of speech and language communication, ideas and positions in this field;

- relying on samples of speeches given by various dictionaries, mass media, to be able to reproduce expressive speech, using knowledge of the laws of logic, rules of conduct of polemists, to be able to defend their position correctly and convincingly;

- work in a team and independently, manage the attention of the audience;

- understand the basics of interpersonal communication, barriers of interpersonal communication and ways to overcome them, the specifics of business communication in various groups and situations, the rules and modern technologies of effective communication, their capabilities and limitations in the field of communication;

- recognize the non-verbal behavior of the communication partners; analyze communication processes, navigate in a variety of communication technologies, adapt to different sociocultural realities, show tolerance to national, cultural and religious differences;

- operate with the basic technologies of effective communication, methods of discussion and controversy, the skills of building constructive communication and the ability to develop themselves in the field of communication.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: interview, colloquium, exam;

2) written work: test, essay;

3) control with the help of technical means and information systems: computer testing programs, exam testing;

4) innovative assessment tools: business (role-playing) game, debate, discussion, project method, incident method, method of successive situations, etc.

Cul2106 Culturology – 3 credits

Prerequisites: MHK1101 Modern history of Kazakhstan

Postrequisites: no.

As a result of studying the discipline, the student is able to:

- describe the morphology and anatomy of culture as a system of parameters and forms in contexts: nature, man, society;
- explain the origin and essence of signs, values, archetypes, symbols as a system of cultural code through correlation with the type of material culture, a certain way of being;
- streamline information about the cultural heritage of the inhabitants of Kazakhstan and determine the channels of their influence on the development of the culture of the Kazakh people;
- to classify the cultural capital of the Turks, to streamline the forms and channels of cultural interaction with the peoples of Western Europe, the Middle East, to identify their contribution to the intellectual and cultural history of humanity and the Kazakh people;
- reasonably and reasonably provide information about the various stages of development of Kazakh culture as a factor in the preservation of cultural heritage and the Kazakh language, including modern state programs for its development and modernization;
- give an objective assessment of the national cultural heritage from the standpoint of maintaining the status of the Kazakh culture, the Kazakh language and their role in shaping the cultural and national identity;
- assess the state of modern Kazakh culture, identify and substantiate the prospects for its development and the direction of modernization; to build programs of professional activities with regard to cultural specificities;
- to objectively evaluate the cultural policy of Kazakhstan and, on its basis, build inter-ethnic and intercultural communications taking into account cultural specifics, enter into a discussion on cultural issues, and reasonably defend one's opinion.

Studying topics:

1. The morphology of culture. The concept and essence of culture.
2. Semiotics culture.
3. The language of culture.
4. Anatomy of culture.
5. Space and forms of culture.
6. Cultural heritage of the inhabitants of Kazakhstan.

7. Culture of nomads of Kazakhstan.
8. Cultural heritage of the Turks of Kazakhstan.
9. Medieval culture of Central Asia.
10. Cultural heritage of the Kazakh people.
11. The formation of the Kazakh culture.
12. Kazakh culture at the turn of the XVIII - the end of the nineteenth centuries.
13. Kazakh culture of the twentieth century.
14. Kazakh culture in the context of modern world processes.
15. Cultural policy of Kazakhstan.

Psy2107 Psychology – 2 credits

Prerequisites: Soc2106 Sociology
Postrequisites: no
As a result of studying the discipline, the student is able to:
- understand the role and place of psychological knowledge in the system of human sciences;
- describe the concepts of personality and interpersonal communication in the context of the formation and modernization of the national consciousness;
- analyze the value-semantic structure of the individual and highlight the main priorities for the purpose of self-determination and personal growth in the framework of the modernization of consciousness;
- use psychological knowledge for career planning and building a professional path;
- assess their own psychological qualities, resources and capabilities;
- justify the value and place of interpersonal communication as a factor in the development of a harmonious personality;
- develop your own strategies for effective interpersonal communication, use the skills of stress management and time management, self-presentation skills to improve personal and professional effectiveness;
- apply different strategies for resolving conflict situations in personal and professional interaction.
Studying topics:
1. Psychology of personality and its role in the system of human sciences.
2. Motivational-need sphere of personality.
3. Emotions and emotional intelligence.
4. Volitional processes and the psychology of self-regulation.
5. Temperament and character.
6. Values, interests, norms as the spiritual basis of personality.
7. Psychology of the meaning of life and professional self-determination.
8. Psychology of career growth.
9. Psychology of communication.
10. Perceptual side of communication.
11. Interactive side of communication.

12. The communicative side of communication.
13. The concept and structure of the socio-psychological conflict.
14. Models of individual behavior in conflict.
15. Techniques and techniques for effective communication.

Ecological Module – 4 credits

As a result of studying the module, student able to:
- know the basic ideas and concepts of ecology and sustainable development;
- distinguish between the basic principles and rules for the safety of human life;
- analyze environmental processes and the formulation of specific tasks and priorities in environmental protection activities;
- analyze the patterns of development of the biosphere and the conditions for maintaining ecological balance and ensuring the environmental safety of the environment;
- use the obtained ecological knowledge, ecological cultures and upbringing for solving specific tasks;
- know about modern theories and practice of ensuring life safety in emergency situations of natural, man-made and social origin, about risk theory and factors causing emergency situations of natural, man-made and social origin, about predicting emergency situations and their consequences, about the main ways, means and methods of individual and collective protection in emergency situations;
- organize rescue operations in emergency situations of various kinds;
- distinguish between legislative and legal frameworks in the field of safety and environmental protection.

Methods for evaluating the achieved results:
Summative assessment, criterial evalution by:
1) oral survey: colloquium, exam;
2) written work: test, essay, laboratory and settlement and graphic work;
3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;
4) innovative assessment tools: case-method, portfolio, business (role-playing) game.

ESD2108 Ecology and sustainable development – 2 credits

Prerequisites: no.
Postrequisites: HC2213 Hydrochemistry, IRBME4229 Integrated River basin management and Ecohydrology, PPMTRK4230 Problem of pollutions of the main transboundary rivers of Kazakhstan.
As a result of studying the discipline, the student is able to:
- determine the basic environmental conditions;
- explain the importance of ecology in the modern world;

- describe the general patterns of the impact of environmental factors on the activity of living organisms; Highlight key environmental factors.
- assess the ecological state of the environment.

HLS2109 Human Life Safety – 2 credits

Prerequisites: no
Postrequisites: no
As a result of studying the discipline, the student is able to:
- demonstrate a conscious and responsible attitude to the issues of personal safety and the safety of others;
- have fundamental knowledge and skills to recognize and evaluate dangerous, harmful factors of the human environment;
- be able to identify ways of protection against damaging factors, measures to eliminate negative consequences;
- distinguish between individual and collective protective equipment;
- assess the condition of the victim in various situations and provide first-aid self-help and mutual assistance in case of danger.

BASIC DISCIPLINES (BD) - 70 credits

OBLIGATORY COMPONENT (OC) – 25 credits

Professional language Module - 4 credits

As a result of studying the module, student able to:

- apply fundamental knowledge about the system of the Kazakh language, the structure and functioning of its units to work with texts in their specialty in order to form a professional world outlook;
- create secondary scientific texts - annotation and abstract description, the ability to summarize scientific information in the form of a thesis statement of the problem.
- apply the basic rules of phonetics and grammar of the studied professionally-oriented Kazakh (Russian, foreign) language, thematic groups of words in the amount of material studied;
- perceive a foreign language by ear;
- own the skills of communication in a foreign language and a wide vocabulary;
- possess the skills of reading and analyzing the material read.
- use the most common speech formulas for standard communication situations;
- use orthoepic, spelling and stylistic norms of the Kazakh (Russian, foreign) language.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: colloquium, exam;

2) written work: test, essay;

3) innovative assessment tools: case-method, portfolio, business (role-playing) game, debate, discussion.

PK(R)L2201 Professional Kazakh (Russian) Language - 2 credits

Prerequisites: K(R)L1104 Kazakh (Russian) Language.

Postrequisites: no.

As a result of studying the discipline, the student will be able to:

- know the orthoepic, orthographic, stylistic norms of the Russian / Kazakh language;
- understand the features of professional oral scientific speech;
- determine the features of professional written scientific speech;
- justify the strategy and tactics of speech communication in the field of professional interaction;
- be able to speak with an oral message;
- to build oral and written statements in different communicative situations;

- understand and analyze the structural and semantic organization of a scientific text;

- perform various operations with the text: describe, summarize information;

- master the technology of interpretation and analysis of the texts of scientific literature in the specialty.

POFL2202 Professionally-oriented Foreign Language - 2 credits

Prerequisites: FL1103 Foreign Language

Postrequisites: no.

As a result of studying the discipline, the student will be able to:

- master the functional features of oral and written professional-oriented texts;

- possess strategies of communicative behavior in situations of international professional communication;

- understand oral (monologue, dialogical) speech within professional topics;

- participate in the discussion of topics related to the specialty;

- independently prepare and make oral reports on professional topics, including using multimedia technologies;

- extract the necessary information from sources in a foreign language created in different sign systems (text, table, graph, diagram, audiovisual series, etc.) in typical situations of professional and business communication.

Module Hydrometeorological – 9 credits

As a result of studying the module, student able to:

- explain the essence of the basic processes of transformation of solar radiation in the atmosphere, the thermal regime of the atmosphere, the phase transformations of water in the atmosphere;

- determine climatic indicators, such as evaporation, moisture index, degree of continentality, etc.

- have an idea of the composition and properties of the hydrosphere, its individual components, the water resources of the planet and its individual parts, the use of water resources by a person and the consequences of economic activity;

- navigate the hydrological information; determine the main characteristics of river runoff and use the transition formulas from one runoff unit to another;

- calculate morphometric and hydrological characteristics of the river system and river basins, characteristics of the river runoff and hydrological regime of the rivers;

- understand the physical nature and regularities of hydrological processes occurring in watercourses and water bodies;

- explain the regularities of the processes occurring in glaciers and wetlands, their types, water balance and hydrological characteristics;

- apply skills in the computational and graphic works using modern tools and techniques.

Methods for evaluating the achieved results:

Summative assessment, criterial evalution by:

1) oral survey: colloquium, exam;

2) written work: test, essay, control work, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: project method, incident method, method of successive situations.

GM1203 General meteorology – 3 credits

Prerequisites: no.

Postrequisites: PhESGK 1210 Physical, economic and social geography of Kazakhstan, HR1205 Hydrology of rivers, HPh2212 Hydrophysics, WBS2214 Water balance studies, HC3207 Hydrological calculations, EWRM3219 Economics of water resources management, GRH3223 General and river hydraulics, WRNH3231 Water-related natural hazard, IMP4232 Introduction to mudflow processes.

As a result of studying the discipline, the student will be able to:

- describe physical properties of atmosphere, its composition and structure;
- describe the laws of heat rotation and water cycle, structure and main regularities of thermal balance of underlying surface;
- formulate the conditions of water vapor condensation in atmosphere and describe the processes of fog and haze formation;
- recall the equation of water vapor transport in a turbulent atmosphere;
- demonstrate basic knowledge of atmospheric statics;
- illustrate the processes of solar radiation transformation in atmosphere;
- perform calculations and estimates of components of radiation and heat balance, simplest radiation characteristics of atmosphere;
- assess the thermal regime of soil and water bodies;
- estimate the atmospheric thermal state;
- explain the reasons for the appearance of surface inversions and temperature inversions in free atmosphere;
- discuss the nature of air currents in atmosphere.

Studying topics:

1. Introduction. The subject, tasks and methods in meteorology, its place among other sciences and the connection with them. General information about the atmosphere. Atmospheric air composition. Changes in air composition with altitude.

2. The equation of state for dry and moist air. Vertical structure of atmosphere. Horizontal inhomogeneity of atmosphere.

3. Forces acting in atmosphere in equilibrium state. The basic equation of atmospheric static.

4. Barometric formulas, pressure step.

5. Solar radiation. General information about radiant energy flow in atmosphere. Basic radiation laws. Solar constant. Spectral composition of solar radiation.

6. Solar radiation scattering in atmosphere. Attenuation of solar radiation in atmosphere. Transmission coefficient and turbidity factor.

7. Terrestrial radiation balance. Atmospheric radiation balance and the system of earth surface – atmosphere. Factors determining their size. The average annual radiation balance of the Earth as a whole.

8. Thermophysical characteristics of the soil. The processes of soil heating and cooling. Diurnal and annual range of soil surface temperature. Distribution of temperature fluctuations into the soil. Natural cover effect on soil temperature.

9. Determination of the boundary and surface layers, their height. Vertical temperature distribution in the surface layer. Diurnal and annual air temperature range. Daily range of air temperature.

10. Surface inversions and temperature inversions of free atmosphere. Heat balance equation of the earth's surface. Heat balance equation of atmosphere and the Earth as a planet.

11. Evaporation under natural conditions. Daily and annual course of evaporation. Methods for evaporation determination. Evaporation. Conditions of water vapor condensation.

12. Physical conditions of formation and classification of fogs. Haze.

13. Wind at the earth's surface. Wind speed and direction. Impact of obstacles on the wind.

14. Gradient force. Forces arising from air movement.

15. Geostrophic wind. Its variation with altitude. Gradient wind in cyclones and anticyclones. Thermal circulation in atmosphere.

FH1204 Fundamentals of hydrology – 3 credits

Prerequisites: no.

Postprerequisites: PhESGK 1210 Physical, economic and social geography of Kazakhstan, RBW1221 River basins of the world, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, WBS2214 Water balance studies, HP2233 Hydrological processes, HFS3215 Hydrological field survey, HSER2233 Hydrology of the seas and estuaries of rivers, HC3207 Hydrological calculation, HF3216 Hydrological forecasts, HM4227 Hydrological modeling, MMGFT4232 Mathematical modeling of the groundwater flow and transport.

As result of studying the discipline student be able to:

- understand the composition and components of the hydrosphere;
- know the general methods of hydrological research;
- apply methods and know the formula for assessing the elements of water and heat balance of water bodies;
- characterize the hydrological regime of the components of the hydrosphere: the World Ocean, glaciers, rivers, lakes, wetlands;

- determine the quantitative characteristics of the river system, basins, valleys and river beds using maps and satellite images;

- understand the factors responsible for the supply and phases of the water regime of rivers;

- navigate the hydrological information;

- determine the main characteristics of the river runoff and use the transition formulas from one runoff unit to another;

- understand the physical processes that cause the water, heat and salt balance, as well as dynamic phenomena and thermal conditions in the oceans, seas and lakes;

- know the types of wetlands, glaciers and types of groundwater and the factors influencing their formation.

Studying topics:

1. Hydrosphere. Science Hydrology
2. Water and heat balance.
3. Water Resources and water problems.
4. General information about the World Ocean.
5. Information on ocean dynamics
6. Hydrographic network and river systems
7. River basins and river valleys
8. River beds and their morphometric characteristics
9. Hydrological regime of rivers
10. Power sources of rivers and phases of water regime
11. Glaciers
12. Information about lakes
13. Thermal and winter regime of lakes
14. Swamps
15. Groundwater

HR1205 Hydrology of river – 3 credits

Prerequisites: HM1208 Higher Mathematics, Phys1209 Physics, GM1203 General meteorology, FH1204 Fundamental hydrology.

Post requisites: Hyd2206 Hydrometry, WBS2214 Water-balance studies, HFS3215 Hydrological field survey, HP2233 Hydrological processes, WRNH3231 Water-related natural hazard, HC3207 Hydrological calculation, EWRM3219 Economics of water resources management, HF3216 Hydrological forecasts, HM4227 Hydrological modeling.

As a result of studying the discipline, the student is able to:

- to know the role of rivers in the water cycle in nature, the main classifications in river hydrology, the main regularities of the hydrological regime of rivers, the factors of spatial and temporal variability of their condition;

- know the principles of rational use and protection of river systems from pollution and depletion;

- be able to independently master additional literature on the academic discipline, use the main hydrological reference materials, and perform laboratory tasks in the sections of hydrology;

- be able to analyze the results of assignments, fully and logically express the mastered educational material;

- apply the knowledge gained about the hydrosphere, the composition of water bodies, the patterns of their distribution and their characteristic hydrological processes; skills of collecting reference hydrological information;

- apply the methods of performing the simplest hydrological calculations, carrying out the main hydrometric works;

- analyze the collected information; develop measures for the protection of river systems;

- organize methodically correctly and at the modern scientific and production level and carry out the main field stationary and expeditionary studies on the study of the hydrological regime and the influence of economic activity on it.

Studying topics:

1. The river as a water body. The role of the river in the global water cycle. Types of rivers
2. River basin and river watershed. Physical-geographical and geological characteristics of the river basin. Morphometric characteristics of the river basin
3. River system and its structure. Density and branching of the river network. River and cross section of the channel. The tortuosity of the river bed. River slope. Valley and river bed. Morphometric characteristics of the river bed
4. Types of rivers supply. Classification of rivers by types of supply A.L. Voeikov and M.I. Lvovich. Rain, snow, glacial and underground feeding of rivers
5. Evaporation of water in a river basin. Factors affecting evaporation. Infiltration. Darcy's filtration law
6. Water balance of the river basin. Equation of water balance. The structure of the water balance of the river basin
7. River runoff as a process; elements of river flow. Flow characteristics
8. Water content and water flow of the river. Natural and anthropogenic factors of the water regime of rivers. Seasonal changes in the visible regime of the rivers. Phases of water regime
9. Collection of materials for the essay solid precipitation: accumulation of snow cover and its main characteristics. The technique of snow shooting
10. Thermal regime of the river. Heat flow of the rivers. Ice phenomena on the rivers. Phases of the ice regime of the rivers
11. Classification of types of water movement. Gravity, friction, centrifugal, Coriolis force. The distribution of flow rates in the river flow
12. The Origin of River Sediments. Slope and channel erosion. Turbidity and sediment consumption. Suspended sediment flow and its determinants. Boarded and their types. The impact of economic activity on the river sediment regime
13. The interaction of flow and channel as the basis of the riverbed process
14. Types of riverbed process

15. The practical significance of the rivers. The impact of economic activity on the regime of rivers

Module Means and methods of measurement and calculation of flow characteristics – 12 credits

As a result of studying the module, student able to:

- know the monitoring system and the organization of observations and studies of water runoff, sediment runoff, water chemical composition, instruments and equipment used in hydrometeorological studies;
- be able to perform field observations of the elements of the water regime;
- possess the methods of producing stationary and field hydrometric works, processing materials and preparing them for printing in the Kazhydromet reference literature;
- analyze the main physical processes occurring in the atmosphere, in their close interaction with the earth's surface and near-earth space;
- apply skills and abilities in solving problems of calculating runoff characteristics;
- use the capabilities of modern PCs in carrying out engineering calculations;
- to summarize the results of practical skills in the computational works (including PC), graphic works, as well as analytical evaluation of the results of calculations.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: interview, colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks;

4) innovative assessment tools: project method, incident method, method of successive situations.

Hyd2206 Hydrometry – 6 credits

Prerequisites: HM1208 Higher Mathematics, Phys1209 Physics, FH1204 Fundamentals of hydrology, GC1218 Geodesy and cartography, HR1205 Hydrology of river.

Postrequisites: WBS2214 Water balance studies, HFS3215 Hydrological field survey, MMSPHI3224 Modern methods of statistical processing of hydrological information, HC3207 Hydrological calculation, EWRM3219 Economics of water resources management, AUHC3217 Assessment of uncertainty in hydrological calculation, HF3216 Hydrological forecasts.

As a result of studying the discipline a student:

- apply the basic principles of the modern organization of hydrometric studies;
- proficient in the organization of hydrometric observations and measurements;

- have an idea about the device of the main instruments and equipment for hydrometeorological research;

- be proficient in the production and preprocessing of observations of liquid runoff and other hydrometeorological elements;

- use in practice the equipment of hydrometeorological observation points;

- possess methods of production of field hydrometric works and processing of field materials;

- use the methods of transmitting the received information;

- possess methods of preparing information for printing and the use of hydrometric information;

- analyze the collected information, summarize the received materials, conduct control, transfer and storage of field materials.

Studying topics:

1. The subject and main tasks of hydrometry

2. Basic principles of the modern organization of hydrometric research

3. Water levels as one of the main characteristics of water bodies.

4. The system of readings and marks on the gauge station

5. Organization of water-measuring observations. The use of automated hydrological complexes. Processing of observations in the RIVER-MODE system.

6. The essence and objectives of the survey works. Methods and instruments for measuring depths. Modern echo sounders and profilographs

7. Processing of materials of survey works using PC and spreadsheets Microsoft EXCEL

8. Measurement of water flow rate. General information about the movement of water in the channel flows. World practice. Hydrometric turntables. Profilographs

9. Measurement of the rate of flow of water in laboratory and extreme conditions.

10. Goals and objectives of determining the water runoff

11. Measurement of water discharges by modern devices - acoustic profilers, runoff rate meters.

12. General information about solid waste. Devices for sampling water with suspended sediment

13. Instruments for the accounting of bottom sediments

14. The study of the chemical composition of water. Selection of observation points, equipment, instruments, field chemical laboratory

15. The procedure and timing of sampling for chemical analysis

16. The main tasks of hydrometry. Its connection with related disciplines. The basic principles of the modern organization of hydrometric studies..

17. Measurement of water discharge. Water discharge model. Methods for determining the water discharge.

18. The scope of work in the measurement of water discharges with flow meter and profilograph. Calculate measured water discharges.

19. Estimated method for determining water discharge. Determination of water discharge by the area of the living section of the flow and the average flow rate calculated by the Shezi formula.

20. Measurement of water discharge in small rivers.

21. The relationship between water discharge and levels and calculations of average daily water discharge.

22. Calculation of water discharge at unsteady movement of water at variable backwater, during deformation of the channel.

23. Distribution of sediment in the living section.

24. The choice of location, measurement of suspended sediment discharges.

25. Processing the measured costs of suspended sediment. Calculation of suspended sediment flow.

26. Observations of the chemical composition of water in the field and in the laboratory.

27. Prospects for the integrated automation of the Hydrometeorological Service. RIVER-MODE system.

28. Application of aviation and space monitoring methods

29. Background environmental monitoring. The concept of the State Water Accounting and Water Cadastre.

30. The main characteristics of measurements and systems for ensuring their unity. Organization of work on the metrological substantiation of hydrological observations.

HC3207 Hydrological calculations – 6 credits

Prerequisites: HM1208 Mathematics, Phys1209 Physics, GM1203 General meteorology, FH1204 Fundamental hydrology, HR2207 Hydrology of river, Hyd2206 Hydrometry, HP2233 Hydrological processes.

Postprerequisites: MMSPHI3224 Modern methods of statistical processing of hydrological information, AUHC3217 Assessment of uncertainty in hydrological calculation, AAIWR4220 Assessment of anthropogenic impacts on water runoff, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS.

As result of studying the discipline student be able to:

- describe the natural patterns and processes of formation of river runoff;
- understand the basic principles of the methods of hydrological calculations;
- to possess methods of mathematical statistics in solving settlement problems;
- apply known algorithms for calculating stock characteristics with representative rows of annual, minimum and maximum runoff;
- perform calculations of stock characteristics and analyze the results in case of insufficiency and lack of data;
- have an idea of the main ways to assess the intra-annual indicators of runoff;
- own the method of arranging the flow of the seasons for water management calculations;
- apply skills in the production of computational and graphic works with the help of modern means and methods;
- understand the theoretical basis for estimating the maximum flow in the absence of data;

- apply the formula for calculating the maximum and solid runoff for specific water management tasks;

- evaluate results and recommendations for solving various water management tasks.

Studying topics:

1. Course content, objectives and stages of development of the discipline. Physical and geographical factors of river runoff.

2. Genetic analysis of hydrological information. Probabilistic-statistical methods for analyzing hydrological characteristics.

3. Correlation and regression analysis. Graphic processing of hydrological data

4. Factors of annual river runoff formation. Calculation of the norm of river runoff with a sufficient period of hydrological observations. Evaluation of the representativeness of a number of observations. Cyclical runoff fluctuations.

5. Statistical analysis of the structure of runoff series. The calculation of the norm of runoff and the assessment of its accuracy with a sufficient observation period.

6. Calculation of the annual river runoff in case of insufficient data. Determination of the annual runoff in the absence of hydrological data. Determination of water discharges estimated probability.

7. Determination of parameters of the security curve of annual runoff in case of insufficiency and lack of data

8. The purpose and objectives of the annual distribution of the runoff. The influence of factors and economic activity on the seasonal distribution of runoff.

9. Calculation of the intra-annual distribution of runoff in the presence of hydrological data.

10. Determination of the intra-annual distribution of runoff in case of insufficiency and lack of hydrological data. Calculation of daily runoff distribution.

11. Calculation of the daily distribution of runoff. Coefficient of natural runoff regulation

12. Minimum runoff. The values of the minimum runoff in the economic of human activities

13. The main provisions of the calculation of the minimum runoff in the presence and lack of hydrological data

14. The calculation of the minimum runoff in the absence of observation materials

15. The calculation of the minimum runoff in terms of economic activity. Freezing and drying of rivers

16. Basic concepts and characteristics. The value of the maximum water discharges for construction design. Catastrophic floods.

17. Determination of parameters of probability curves of maximum runoff in the presence of a long period of observations. Accounting for outstanding maximum water discharges. Warranty amendment.

18. Bringing the parameters of the probability curves of maximum water runoff over a long period. Accounting for the impact of economic activity.

19. Calculation of the maximum runoff in the absence of hydrological observations. Maximum runoff scheme. Genetic formula of runoff.

20. Reduction of the maximum modules of the flood discharge (flood).

21. The maximum runoff of floods. Conditions for the formation of runoff floods.

22. Calculation of maximum water discharges in the absence of hydrological data.

23. Maximum runoff of rain floods. Estimated characteristics of floods.

24. Calculation of rainfall

25. Formulas for calculating the maximum flow of floods.

26. Methods for constructing hydrographs of flood and floods.

27. Mathematical modeling of the flow hydrograph.

28. Calculation of the highest river water levels in the presence, insufficiency and absence of data. Calculation of the highest levels of lakes.

29. Factors determining sediment discharge. Distribution of river turbidity over the territory.

30. Calculation of suspended sediment runoff. Calculation of runoff sediment load.

ELECTIVE COMPONENTS – 45 CREDITS

STEM-module – 6 credits

As a result of studying the module, a student is able to:

- reproduce the basic definitions, theorems and rules of higher mathematics, have an idea of their practical application for solving mathematical and natural-applied problems, describe the most important methods of mathematical research;
- use mathematical theorems, rules and methods of research in the study of atmospheric processes;
- to classify the basic concepts and methods of linear algebra, analytical geometry, differential calculus of a function of one and several independent variables, integral calculus of a function of one and several independent variables;
- use the fundamental laws, theories of classical and modern physics, as well as the methods of physical research in their professional activities, solve typical problems of the discipline from various fields of physics;
- have skills in modeling physical situations using a computer;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test;

3) control with the help of technical means and information systems: computer testing programs, exam testing, training tasks for specialized programs;

4) innovative assessment tools: the method of projects, the methodology of successive situations.

HM1208 Higher mathematics – 3 credits

Prerequisites: no.

Postrequisites: HR1205 Hydrology of river, GC1211 Geodesy and Cartography, Hyd2206 Hydrometry, HC3207 Hydrological calculations, HF3216 Hydrological forecasts, HPh2212 Hydrophysics, HFS3215 Hydrological field survey, AUHC3217 Assessment of uncertainty in hydrological calculation, HELR2218 Hydraulic engineering and land reclamation, MMGFT4232 Mathematical modeling of the groundwater flow and transport.

As a result of studying the discipline, the student will be able to:

- achieve good understanding of basic concepts and to be able to apply these concepts to a variety of mathematical situations;
- know the basic fundamental concepts of Higher mathematics: the basic definitions, theorems, rules, methods and formulas of linear algebra, analytic geometry and vector algebra, the theory of limits and foundations of calculus, Integral theory, function of several variables, differential equations;
- state and prove basic theorems related to the concepts above; analyze the application of the theory in different situations, compare and contrast the obtained results;
- provide written explanations of the ideas behind key concepts from the course;
- clearly present and explain solutions to problems in both written and verbal form;
- apply mathematical reasoning and mathematical analysis to solve theoretical and applied problems;
- have the skills of working with the special literature.

Studying topics:

1. Matrices. Elementary Matrix Operations. Determinants of the 2nd and 3rd-order properties
2. Rank of a matrix. Elementary Transformations. The inverse matrix. Computation of the inverse matrix
3. The system of linear equations. Cramer's rule. Method of Gauss-Jordan. Matrix method for solving systems of equations
4. Vector and basic concepts. Linear operations with vectors. The Linear dependence of vectors. Basis. Coordinates of vector in a basis
5. The analytical geometry's simplest tasks. The equation of a curve on a plane. Different equations of a line. The angle between two lines. Conditions parallelism and perpendicularity of two lines. The distance from the point to the line.
6. The concept of function and classification functions. Limit of function. Infinitely small and the theorem about them. 1st and 2nd remarkable limits
7. The definition of continuity at a point. Properties of continuous functions. Basic theorems on continuous functions
8. Derivative of a function at a point. Derivative of composite and inverse functions, rules of differentiation.

9. Application of the differential in the approximate calculations. L'Hospital's rule. A necessary and sufficient condition for the extremum of the function. Convexity, concavity of the curve.

10. Definition and properties of indefinite integrals. Table of integrals. Methods of integration: the method of substitution and integration by parts

11. The definite integral as the limit of sum. Properties of the definite integral. The Newton-Leibniz formula. Methods of integration.

12. Function of several variables. Domain. Level curves. Partial derivatives. Total differential.

13. Extremum of a function of two variables. Necessary and sufficient conditions for an extremum.

14. Problems leading to differential equations. Basic definitions. Initial condition. Differential Equations of the 1-st order. Elements of qualitative analysis of differential equations of the 1-st order. Equations with separated variables.

15. Differential Equations of the 2-nd order. Equation of the 2-nd order equation admitting a reduction of order. Homogeneous linear equations of 2-nd order, definitions and general properties.

Phys1209 Physics –3 credits

Prerequisite: no

Postrequisite: HR1205 Hydrology of rivers, Hyd2206 Hydrometry, HC3207 Hydrological calculation, HPh2212 Hydrophysics, GRH3223 General and river hydraulics.

As a result of learning the discipline, the student is able:

- to demonstrate the ability to use the fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of the system of professional activity;
- to summarize the skills and abilities to solve typical tasks of the discipline from various fields of physics as the basis for the ability to solve professional problems;
- to make decisions to choose methods of the decision, both in an analytical form, and with use of computer technologies.
- to use acquired knowledge and skills to solve practical problems of everyday life, to ensure the safety of their own lives, environmental management and environmental protection.
- independently to conduct experimental physical studies, process the results and to evaluate the orders of physical quantities

Studying topics:

1. Elements of kinematics, Dynamics of a material point and a system of points, Non-inertial reference systems

2. Work and energy. Solid motion

3. The movement of liquids and gases. Mechanical vibrations and waves

4. Molecular-Kinetic Theory, Statistical and Thermodynamic Methods for Studying Molecular Systems

5. The first and second law of thermodynamics

6. Electric field. Conductors and dielectrics in an electric field

7. Constant electric current. Power and current density. Emf. Electric current in gases. Types of discharges in gases in the atmosphere. Aurora Borealis

8. A magnetic field. Ampere's law. The law of Bio-Savara-Laplace. Faraday law of electromagnetic induction.

9. Magnetism of matter, Earth's magnetic field, mechanism of its occurrence, Alternating current

10. Electric oscillations, Electromagnetic field, Basic principles of Maxwell's theory

11. The interaction of light with matter, Wave and quantum ideas about the nature of light. Huygens principle

12. Interference and diffraction of light. Coherence waves. Diffraction pattern, grating. Polarization of light

13. Photons and their properties. The structure of the atom. Physics of the atomic nucleus and elementary particles

14. Solid State Physics. The crystalline structure of solids. Amorphous bodies

15. The structure and development of the universe. Our star system is the galaxy. Other galaxies. Infinity of the universe

Module Physical-geographic aspects in hydrology – 4 credits

As a result of studying the module, a student is able to:

- unmistakably navigate in the geographical nomenclature of the country, identify the types of structures of the high-altitude zone landscapes;
- analyze the influence of physical-geographical factors on the formation of landscapes;
- to compile the physical-geographical characteristics of the area according to literary and cartographic materials and give a comparative analysis of the nature of different areas.
- to make mathematical calculations in geography, to build complex physical and geographical profiles;
- be able to solve various graphical and analytical tasks on the plan and map;
- perform geodetic measurements and using basic and accurate instruments for geodetic measurements, process the results of geodetic measurements and topographical surveys with the further construction of topographical plans and terrain profiles;
- possess techniques and methods for processing geodetic information for the purpose of organizing observations at the hydrological station;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: interview, colloquium, exam;

2) written work: test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative evaluation tools: portfolio, business (role) game, discussion.

PhESGK 1210 Physical, economic and social geography of Kazakhstan - 2 credits

Prerequisites: GM1203 General meteorology, FH1204 Fundamentals of hydrology.

Postrequisites: HLR2222 Hydrology of lakes and reservoirs.

As a result of studying the discipline, the student will be able to:

- work with cartographic materials, electronic resources, giving information about the natural features of the territory;
- methodically correctly develop and justify the schemes of physical and geographical zoning;
- identify the natural resource potential of the territory and the possibilities for its economic development;
- to understand, present and analyze economic and geographical information, use theoretical knowledge in practice;
- to conduct an economic assessment of natural resources.

Studying topics:

1. General information about the country. Geographical position. Territory and boundaries.
2. Geological history and paleogeography. Geological structure. Main features of orography and organization of a surface. Modern processes of terrain formation.
3. Climate conditions. The analysis of major climate factors. The characteristic of basic meteorological elements by seasons of year.
4. Surface water and their resources. Features of hydrography.
5. Soil and vegetable cover, natural zones of Kazakhstan. Landscape Altitudinal Zonality. Physiographic division into districts.
6. Environmental problem and conservation. Zones of ecological disasters. Reserves and national parks
7. A role of physical geography at the present stage of interaction of the nature and society.
8. General information about the Republic of Kazakhstan. Brief characteristic of economy and geography of the population of the Republic of Kazakhstan.
9. Development of the extracting industries of Kazakhstan. Geography of ferrous metallurgy of Kazakhstan. Geography of non-ferrous metallurgy of Kazakhstan
10. Geography of the oil and gas industry. Geography of the chemical industry
11. Geography of mechanical engineering of the Republic of Kazakhstan
12. Geography of light and food industry.

13. Geography of agricultural industry of the Republic of Kazakhstan
14. Geography of transport of the Republic of Kazakhstan.
15. Foreign economic activity of Kazakhstan

GC1211 Geodesy and cartography - 2 credits

Prerequisites: HM1209 Higher Mathematics, FH1204 Fundamentals of hydrology.

Postrequisites: Hyd2206 Hydrometry, HELR2218 Hydraulic engineering and land reclamation, GARBM2233 Geomorphological approach to river basin management, HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management.

As a result of studying the discipline, the student is able to:

- understand the specifics of scientific knowledge and research methodology in the framework of the course of geodesy and cartography;
- apply scientific knowledge and knowledge of the research methodology in the practice of analyzing geodesic and cartographic materials in the context of modern scientific paradigms; to form the ability to critically analyze, evaluate and synthesize new ideas in the context of modern paradigms of cartography and geodesy.
- perform your own research and present them in the form of a specific project (maps, plans);
- analyze and apply the results of cartographic works;

Studying topics:

1. The subject of geodesy, its content and objectives. Connection of geodesy with other sciences.
2. Coordinate systems on the Earth's surface. Geographic, rectangular, polar coordinate system. Forward and reverse geodetic tasks.
3. Orientation. Orientation angles. Deflection. Methods for determining the declination of the magnetic needle. Magnetic true azimuth. Rumba The relationship between azimuths and points.
4. Nomenclature of topographic maps. Graphic of sheets of topographic maps of various scales.
5. Conventional signs of topographic maps (point, out-of-scale, linear and contour, scale).
6. Relief and methods of its image on the maps. The height of the cross section of the relief. Horizontals. Pledging. Slope steepness. Absolute Exceptions. Profile.
7. Angle measurements. Measurement of the horizontal angle. Methods for measuring horizontal angles. Accuracy of angular measurements.
8. Theodolite survey. Stages and methods of theodolite survey.
9. Measurement of distances between points of terrain. Types of linear measurements; measuring instruments for direct measurement of line lengths. Accuracy.
10. Leveling. Types of leveling. Instruments. Classification levels. Geometric leveling.

11. Leveling the track. Leveling control methods. Allowable residuals. Calculating binder and intermediate marks.

12. Planned reference geodetic networks. The essence of the triangulation method, the method of polygonometry. Trilateration method.

13. State reference high-altitude network. Types of leveling. Classification, accuracy of determining the heights of different levels of leveling.

14. Tacheometric survey. Instruments for the production of tachleshmetrical survey.

15. Safety measures during topographic and geodetic works.

Module Physical-chemical aspects in hydrology - 6 credits

As a result of studying the module, a student is able to:

- demonstrate deep knowledge of all sections of hydrochemistry;
- to evaluate the methods of research of chemical processes and phenomena at the empirical and theoretical level;
- apply the methods of studying the chemical composition of natural waters, carry out a physicochemical analysis of water; classify the data obtained on the basis of regulatory requirements to understand the physical nature of hydrological phenomena and processes;
- be able to apply fundamental physical laws and mathematical methods in the analysis of natural processes in water bodies and their interaction with the environment;
- rightly choose the research methods and methods for calculating the hydrophysical characteristics;
- evaluate research methods and methods of calculation and their validity and reliability.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: case-method, portfolio, business (role-playing) game.

HPh2212 Hydrophysics – 3 credits

Prerequisites: GM1203 General meteorology, HM1208 Higher mathematics, Phys1209 Physics.

Postrequisites: HLR2222 Hydrology of lakes and reservoir, HP2233 Hydrological processes, HSER2233 Hydrology of the seas and estuaries of rivers, HPCS3228 Hydrodynamic processes of the Caspian Sea.

As a result of studying the discipline, the student is able to:

- apply the knowledge gained about hydrophysical laws, substantiate the conclusions of hydrophysical laws, interpret the results obtained;

- demonstrate an understanding of the general structure of the science of hydrophysics and the links between its elements, explain the essence of the laws of hydrophysics;

- use the laws of hydrophysical processes in the context of the basic knowledge of the specialty, interpret its content;

- analyze learning tasks and be able to solve them;

- to argue the correctness of the choice of a particular hydrophysical method for solving the problem;

- use hydrophysical methods of calculation and analysis in individual or group teaching and research activities;

- summarize, interpret and evaluate the learning outcomes in the context of the discipline;

- apply the studied materials in hydrophysical calculations;

Studying topics:

1. The role of physics in the study of hydrological phenomena and in hydrological calculations. Brief history of hydrophysics development.
2. Features of the molecular structure of water.
3. Physical properties of ice.
4. Physical properties of snow.
5. Stirring water in water reservoirs.
6. Waves.
7. Heat exchange in an aqueous medium.
8. Annual thermal cycle of reservoirs.
9. Equation of heat balance.
10. Evaporation.
11. Calculation of evaporation. Factors affecting evaporation.
12. Ice-thermal processes
13. The initial thickness of ice.
14. Melting of the ice cover.
15. Destruction of the ice cover

HC2213 Hydrochemistry – 2 credits

Prerequisites: ESD2108 Ecology and sustainable development.

Postrequisites: HP2233 Hydrological processes, AAIWR4220 Assessment of anthropogenic impacts on water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment, PPMTRK4230 Problem of pollutions of the main transboundary rivers of Kazakhstan.

As a result of studying the discipline, the student will be able to:

- demonstrate knowledge of basic chemical phenomena and processes occurring in the hydrosphere.

- describe the chemical composition of natural waters, the patterns of its variability in time and space.

- interpret the properties and interaction of chemical elements and their compounds on the basis of the periodic law and the structure of the electron shells of atoms and solve quantitative problems corresponding to these transformations.
- classify the processes of formation of natural waters and the features of their chemical composition.
- interpret information on the chemical composition of natural waters and use it to assess the processes occurring in the hydrosphere.
- apply information about analysis methods in hydrochemistry, theories of strong electrolytes, salt formation, self-cleaning, etc.
- professionally draw up and present research results.
- analyze the laws of chemical kinetics, elements of thermodynamics, theory of solutions and redox processes.

Studying topics:

1. Introductory terms and concepts. Definition of science "hydrochemistry", goals and objectives of the course. Hydrochemistry as a science, its subject, tasks and connection with other sciences.
2. The main laws. Structure of atom. Quantum numbers. Shape and orientation of orbitals. The Periodic law.
3. Chemical bond, structure of molecules, characteristics of interacting atoms.
4. The rate of chemical reactions in the hydrosphere. Factors affecting the rate of chemical reactions. Chemical equilibrium.
5. Redox processes occurring in natural waters. Redox potential, its measurement and calculation.
6. Water and its properties.
7. Formation of the chemical composition of natural waters.
8. Chemical processes in natural waters. Water as a solvent, dissolution processes and their energetics.
9. Properties of water as a solvent, dissociation of water. Ionic product of water and hydrogen index.
10. The most important properties of aqueous solutions.
11. Diluted solutions.
12. Hydrolysis and its role in natural waters. The concept of buffer and buffer solutions.
13. Impact of external conditions on the composition and properties of water.
14. Assessment of surface water pollution. Monitoring of the state of water bodies.
15. Behavior of radionuclides in natural waters.

Module Applied Aspects in Hydrology– 6 credits

As a result of studying the module, a student is able to:

- organize exploration work on rivers, lakes, reservoirs at different stages of designing objects for various purposes;
- collect, process, synthesize and analyze data on water bodies necessary for their comprehensive characterization, including environmental;

- prepare, collect and submit the necessary information for the hydrological study of projects of hydraulic structures and measures for the use and protection of water bodies, for the environmental assessment of projects;

- have an idea of the principles of conducting an environmental impact assessment of projects.

- apply knowledge in solving problems of calculating stock characteristics;

- possess the main methods for calculating river flow and be able to apply them in the presence of reliable observation materials and in their absence

- to acquire practical skills in the production of computational work, graphic work, as well as analytical evaluation of the results of calculations;

- perform calculations of stock characteristics and analyze the results in case of insufficiency and absence of data.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: interview, colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: case-method, portfolio, business (role-playing) game, project method.

WBS2214 Water balance studies - 3 credits

Prerequisites: GM1203 General meteorology, FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, HLR2222 Hydrography of lakes and reservoirs.

Postrequisites: EWRM3219 Economics of water resources management, IRBME4229 Integrated River basin management and Ecohydrology, RSGEC3231 River system and global environmental change, ECCWM4232 Effects of climate change on watershed management, MMGFT4232 Mathematical modeling of the groundwater flow and transport.

As a result of studying the discipline, the student is able to:

- master the methods and methodology of water-balance research;

- have an idea of the basic regularities of formation of various elements of the water balance: precipitation, runoff, total evaporation, etc .;

- apply the methods of calculation of individual elements of the water balance and make up the water balance equations for various water bodies and territories;

- use basic hydrological reference materials;

- possess the skills of processing field materials, be able to analyze the results of water-balance research;

- apply in practice the methods of calculation of individual elements of the water balance and constitute the water balance equations for various water bodies and territories;

- analyze the hydrological processes and phenomena on rivers and in their basins;

- assess the impact of economic activity on the components of the water balance;

- carry out calculations of both individual elements of the water balance and the water balance of various water bodies, territories, and organize water-balance observations.

Studying topics:

1. The studies of the water balance of surface waters and its connection with other sciences
2. Scientific and applied value of water-balance researches. Stages of development, current state and prospects for the development of water-balance research in Kazakhstan
3. General equation of water balance. The equation of water balance of various water bodies
4. Atmospheric precipitation. Methods of measurement and calculation of precipitation. Random and systematic errors in the measurement of precipitation. Selection of reference instruments and methods for measuring precipitation. Correction of measured precipitation.
5. Methods of observing snow cover. Production of snow surveys in the field in the forest. Processing and analysis of the results of observations. Remote methods for the study of snow cover. Observations on the depth of freezing and thawing of soils.
6. River runoff. Experimental study of runoff. Runoff under channel
7. Methods of measuring and calculating moisture reserves in soil and priming. Methods and instruments for measuring humidity, calculating moisture reserves in soils. Study of the groundwater regime as applied to the calculation of the water balance of water bodies.
8. Total evaporation, general provisions and history of research
9. Methods of experimental research of evaporation of land (water balance of a land area, water balance of an isolated soil monolith)
10. Methods based on determining the flow of water vapor in the atmosphere. Calculation methods for the determination of evaporation, based on the coupling equations with meteorological elements. Semi-empirical methods
11. Calculation of evaporation from a specific underlying surface. Methods for determining evaporation from forests and swamps
12. Principles and methods of statistical estimation of errors in water balance measurements. Assessment of accuracy of water balance calculations
13. Changes in moisture reserves of a river catchment
14. Regional water balances. Water balance and water resources of the CIS
15. World water balance and water resources of the Earth

HFS3215 Hydrological field survey - 3 credits

Prerequisites: HM1208 Higher Mathematics, FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, GC1211 Geodesy and cartography, Hyd2206 Hydrometry, HELR2218 Hydraulic engineering and land reclamation.

Postrequisites: EWRM3219 Economics of water resources management, AAIWR4220 Assessment of anthropogenic impacts on water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment, HSER2233 Introduction to mudflow processes, GARBM4230 Geomorphological approach to river basin management.

As a result of studying the discipline, the student is able to:

- possess the principles of organizing and conducting survey work on water bodies;
- apply in practice the methods of processing and analysis of the obtained survey materials;
- show the features of surveys for the integrated use of water bodies and for objects of various purposes;
- formulate the requirements for design, construction and operating organizations of water bodies and facilities;
- interpret environmental issues in the design of hydraulic structures;
- have an idea of what information about the ecological status of water bodies is required for the project and its environmental impact assessment;
- systematize the design stages and describe the peculiarities of survey work at each stage;
- describe the main safety requirements in the production of survey work;
- formulate methods of collecting and submitting the necessary information for the hydrological study of projects of hydraulic structures and measures for the use and protection of water bodies, for the environmental impact assessment of projects.

Studying topics:

1. Tasks of water technical surveys. Connection survey with the design and construction.
2. Organization and basic survey documents.
3. The composition of work for the integrated use of water bodies. Topo-geodetic work.
4. Gauging work on the rivers.
5. Exploration of the rivers.
6. Morphometric works on the rivers.
7. Morphometric works on the rivers (determination of the type of the channel process and assessment of channel deformations).
8. Hydrometric works on the rivers. The applying of aerometods. Hydrometric works at WTS.
9. Survey and study of lakes and reservoirs.
10. Research of glaciers. Research of Swamps.
11. Meteorological works. Geological works.
12. Surveys for bridges. Bridge transitions.
13. Surveys for shipping. Surveys for water reclamation.

14. Surveys for crossings of electro power lines and pipelines across rivers.

15. Environmental issues in surveys and design. Safety elements in surveys on water bodies.

Module Calculating and practical aspects in hydrology – 9 credits

As a result of studying the module, a student is able to:

- collect and process the necessary baseline data for making forecasts;
- decipher the hydrological telegrams;
- develop methods for forecasting a particular hydrological regime in relation to a specific water body;
- assess the quality of the methodology and predictability
- to perform calculations of a given channel process in order to predict the expected deformations and taking into account the interaction of engineering structures;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: case-method, portfolio, business (role-playing) game.

HF3216 Hydrological forecasts - 6 credits

Prerequisites: HM1208 Higher mathematics, FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, HP2233 Hydrological processes, HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological information, AUHC3217 Assessment of uncertainty in hydrological calculation.

Postrequisites: MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling, HSWC4229 Hydrological services for the water consumers.

As a result of studying the discipline, the student is able to:

- know the composition and content of hydrological information;
- collect and process the necessary baseline data for making forecasts;
- use methods for assessing the quality of hydrological forecasting techniques;
- apply the methods of short-term forecasts of ice phenomena on rivers, lakes and reservoirs.
- evaluate the quality of the methodology and predictability.
- understand the methodological basis of forecasting the flow of mountain rivers;

- demonstrate modern knowledge of the conditions of formations of the spring runoff of lowland rivers of Kazakhstan;

- analyze the influence of soil conditions on the formation of spring runoff;

- know the general view of the dependence of the flood flow on the determining factors;

- assess the quality of long-term forecasts;

- to determine the features of the method of forecasting ice phenomena of the rivers of Kazakhstan;

- to develop methods for long-term forecast of a hydrological phenomenon in relation to a specific water body.

Studying topics:

1. General information on hydrological forecasts

2. Hydrological information

3. Assessment of the quality of the methodology and the accuracy of hydrological forecasts

4. Accepted methods for assessing the quality of forecasting techniques

5. Forms and methods of expressing forecasts.

6. Short-term projections of water discharge and water levels according to the method of respective levels

7. Forecast of water discharge, taking into account the transformation of the flood.

8. Forecast of the water runoff according to the linear trend method.

9. Physical basis of rainfall forecast. Determination of runoff losses.

10. Short-term forecast of rain runoff.

11. Short-term forecasts of ice occurrence on rivers, lakes and reservoirs. Method L.G. Shulyakovsky. Physical-statistical empirical dependencies.

12. Short-term forecast of the beginning of freeze-up on rivers, lakes and reservoirs.

13. Forecast of thickness of ice cover

14. Model of opening of rivers, lakes and reservoirs

15. Forecasts of the opening of rivers using physical-statistical dependencies

16. General questions of the theory of the formation of floods and flooding

17. Methodical bases of long-term forecasts for spring flood runoff.

18. Determination of losses of melt water

19. Methods of forecasting runoff for the period of high water in selected geographical areas

20. Methodology of long-term forecasts of maximum water discharges, water levels

21. Forecast of the beginning of the flood and the time of the occurrence of maximum water flow

22. Forecast of the hydrograph of runoff of flat rivers during the flood period

23. Long-term forecasts of low-water run-off on lowland rivers.

24. Features of the formation and flow factors of Mountain Rivers

25. Determination of the main factors necessary for the development of methods for forecasting the flow of Mountain Rivers

26. Determination of the characteristics of the remaining snow reserves and the height of the seasonal snow line

27. Runoff forecasts for the vegetation season

28. Long-term forecasts of ice phenomena, based on the characteristics of atmospheric processes.

29. Long-term forecasts of ice phenomena based on a synoptic-statistical method

30. Improved methods for long-term forecasts of freezing and opening of rivers.

AUHC3217 Assessment of uncertainty in hydrological calculation – 3 credits

Prerequisites: HM1208 Higher mathematics, Hyd2206 Hydrometry, HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological information.

Postrequisites: HF3216 Hydrological forecasts, HSWC4229 Hydrological services for the water consumers, AAIWR4220 Assessment of anthropogenic impacts on water runoff.

As a result of studying the discipline, the student is able to:

- demonstrate an understanding of the distinction between systematic and random errors;
- calculate the absolute and relative errors of hydrological calculations;
- assess the effectiveness of bringing the norm and coefficients of variation to a multiyear period;
- assess the accuracy of the calculation of the norm and coefficients of variation given by a multi-year period;
- assess the accuracy of hydrological calculations in case of insufficiency and the absence of observational data;
- random errors in group analysis of hydrological data;
- to determine the error of hydrological calculations in a joint analysis of a statistically heterogeneous population;
- summarize, interpret and evaluate the results of learning in the context of the discipline, training module, content of the midterm exam (specifically).

Studying topics:

1. Subject and objectives of the discipline. Types of errors. Features of errors of hydrological measurements and calculations.
2. Absolute and relative errors. Random, systematic errors and misses
3. Error distribution function
4. Random and systematic random errors of selective parameters
5. Random errors of distribution quintiles. Random and systematic errors in the evaluation of empirical security
6. Accounting for errors in the source data when estimating the election distribution parameters. Accounting for random errors in the evaluation of autocorrelation functions. Accounting for random errors of the initial data when estimating linear regression parameters.

7. Construction of curves of security for non-uniform samples.

8. Estimation of errors in calculations based on generalized probability distribution curves.

9. Calculation error in the joint analysis of statistically heterogeneous populations.

10. Evaluation of random and systematic errors in group analysis of hydrological characteristics.

11. Accounting for random and systematic errors in the evaluation of distribution parameters for a group of rivers.

12. Evaluation of the effectiveness of bringing the norm and coefficients of variation to a multiyear period.

13. Assessment of the accuracy of determining the norm and coefficient of variation of a series reduced to a long-term period.

14. Random errors of methods for calculating runoff parameters based on materials of short-term observations.

15. Evaluation of the accuracy of hydrological calculations in the absence of observational data.

Module Solution of water management issues – 9 credits

As a result of studying the module, a student is able to:

- to assess the economic efficiency of the use of hydrological information;
- master the principles and methods of finding optimal economic solutions and advise consumers on the most advantageous application of hydrometric information;
- use the knowledge gained in the hydrological study, design and operation of hydraulic systems;
- assess the impact of hydrological constructions on the hydrological regime of water bodies;
- to solve problems of water management and water energy calculations, namely: to determine the hydropower resources of the watercourse, to develop water management balances for river basins;
- carry out calculations of the regulation of the flow of reservoirs in order to determine their main parameters, to give an economic assessment of the national economic efficiency of water management measures;
- possess the skills of the simplest calculations: water requirements of irrigation, industry and public utilities, counting and building the characteristics of a reduced integral curve, calculating seasonal and long-term river flow regulation for a constant return using integral curves,
- carry out calculations of the long-term reservoir capacity by a statistical method and using nomograms; calculations of flood control by of reservoirs.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: interview, colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: case method, portfolio, business (role-playing) game, project method, incident method.

HELR2218 Hydraulic engineering and land reclamation– 3 credits

Prerequisites: HM1208 Higher mathematics, GC 1211 Geodesy and Cartography.

Postprerequisites: HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management, AAIWR4220 Assessment of anthropogenic impacts on water runoff, WRNH3231 Water-related natural hazard.

As a result of studying the discipline, the student is able to:

- use the knowledge gained in the hydrological justification,
- classify in the design and operation of waterworks;
- assess the impact of hydraulic structures on the hydrological regime of water objects;
- determine the purpose, types and arrangement of hydraulic structures used in certain branches of the water economy;
- to predict the possible negative consequences from the impact of hydroconstructions on water objects and the environment;
- analyze the structures and activities in the fight against the harmful effects of water;
- use basic calculations for the stability of hydraulic structures,
- apply the calculation of water filtration through the body and foundation of earth dams,
- practice calculations to determine the thickness of the flute.

Studying topics:

1. Introduction. Definitions of basic concepts.
2. Influence of hydrotechnical construction on the environment.
3. Hydrotechnical constructions, their classification according to various characteristics.
4. Dams, their types. About filtration of water through the body and base of the dam.
5. Concrete dams. Concrete and iron-concrete dams. Concrete lightweight gravity dams. Buttress dams. Arched dams. Dams with low threshold.
6. Culvert in the body and outside the body of the dam.
7. Water supply facilities. Channels, their types, shape and dimensions of the cross section.
8. Water intakes. Types of river water intakes. Damless and dams water intakes.
9. Use of water energy. Main schemes of water energy use.
10. Water supply of human settlements and industrial enterprises. Water diverting.

11. Water supply schemes for industrial enterprises

12. Water melioration. Types of melioration. The study of land reclamation on the example of the Akdala irrigation array (Kazakhstan) and the Albufera Lake (Spain).

13. Types and methods of irrigation.

14. Inland waterways. Waterways and ways to improve navigational conditions.

15. Hydrotechnics of fisheries

EWRM 3219 Economics of water resources management – 3 credits

Prerequisites: GM1203 General meteorology, HM1208 Mathematics, GC1211 Geodesy and cartography, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, WBS2214 Water balance studies, HELR2218 Hydraulic engineering and land reclamation, HFS3215 Hydrological field survey.

Postrequisites: AAIWR4220 Assessment of anthropogenic impacts on water runoff, HSWC4229 Hydrological services for the water consumers, IRBME4229 Integrated River basin management and Ecohydrology, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment, UH3231 Urban hydrology.

As result of studying the discipline student be able to:

- know the basic concepts of water economy, water complex and comprehensive use of water;
- know the theoretical foundations of regulation river flow calculations using the reservoirs;
- taking into account there quirements of the economic sectors to provide them water;
- apply methods for efficient use of water resources with considering environmental requirements,
- develop economics of water resources management balances for river basins,
- justify the environmental consequences of using surface water;
- reconcile the requirement of various industries to water resources and water sources;
- understand the economics features of water resources management calculations;
- carry out calculations of the regulation flow in reservoirs with the aim of to determining their main parameters;

give an economic assessment of effectiveness in water management activities.

Studying topics:

1. Introduction. The purpose and objectives of the course «Economics of water resources management calculations and calculation».

2. The concept of water economy and water management complexes.

3. Water consumption in irrigation.

4. Liman irrigation. Classification of limans irrigation.

5. Industrial water supply. Water supply of housing-municipal.

6. The concept of water management complex.
7. Reservoirs - basic elements, regime, classification.
8. The concept of economics of water management calculations.
9. The main provisions of theory in flow regulation
10. Application of integral runoff curves in water management calculations.
11. Calculations of regulation flow by integral curves on the tough schedule of water consumption.
12. Types of calculations in regulation flow
13. Calculations of regulation flow by methods of mathematical statistics.
14. Regulation flow to variable return. Dispatch schedules.
15. Regulation flow on floods and high waters

AAIWR4220 Assessment of anthropogenic impacts on water runoff – 3 credits

Prerequisites: HC2213 Hydrochemistry, HC3207 Hydrological calculations, HELR2218 Hydraulic engineering and land reclamation, HFS3215 Hydrological field survey, AUHC3217 Assessment of uncertainty in hydrological calculation, EWRM 3219 Economics of water resources management, UH3231 Urban hydrology, PPMTRK2233 Problem of pollutions of the main transboundary rivers of Kazakhstan.

Postrequisites: no

As result of studying the discipline student be able to:

- understand the main criteria for the quantitative assessment of changes in river flow;
- assess the impact of factors of various economic activities on the flow;
- apply methods and principles for estimating changes in runoff caused by anthropogenic factors for flat and mountain rivers;
- to know the current trends in the development of the hydrological regime in connection with the economic activity of man;
- use mathematical statistics to solve computational problems;
- perform calculations of the hydrological characteristics of the runoff in conditions of anthropogenic impact on the regime of rivers;
- synthesize information about the object of research and analyze the results of calculations;
- to formulate recommendations for the rational use of water bodies and assess the current state of the water resources of river basins.

Studying topics:

1. Problems of growth of water consumption. Anthropogenic runoff transformation
2. Methods of research and assessment of the impact of anthropogenic factors on river flow. Scientific and methodological basis for quantitative assessment of changes in river flow.
3. Methods for assessing the impact on the flow of the entire complex of economic factors. River basins of mountain rivers with zones of formation and use of flow

4. Large river systems of lowland areas (based on calculations performed for the rivers of the Volga and the Dnieper). Flat watersheds of medium rivers

5. Methods for differentiating the impact on the flow of certain types of economic activity. Channel regulation

6. Irrigation of drylands. Agroforestry measures. Dehumidification of swamps and wetlands. Industrial and public water supply and sewerage

7. Comprehensive assessment of the change in river runoff of mountain rivers due to economic activity

8. Changes in the flow of the Syr-Darya and Amu Darya rivers under the influence of economic activity. Assessment of the impact of economic activity on the flow of large rivers of lowland areas

9. Assessment of anthropogenic impacts on the runoff of some rivers in Kazakhstan. The problems of Zhayik and Elek

10. Change in the flow of the river Ile under the influence of economic activity

11. The impact of economic activity on the annual flow of the river Tobyl.

12. Changes in the discharge of the Yesil River due to channel regulation

13. Quantitative assessment of changes in the flow of the river Nura

14. Evaluation of the influence of the Bukhtarma reservoir and the Ertis-Karamay canal on the flow of the Ertis river

15. Water resources of the Earth. Features of water consumption in the world. The impact of economic activity on the river flow and the water balance of the continents

Module Global hydrology and hydrology of reservoirs - 6 credits

As a result of studying the module, a student is able to:

- to orient in the geographical location of the most significant water bodies on World maps;
- know the hydrographic characteristics of the main water bodies of the Earth;
- show knowledge when performing hydrographic studies and analyzing the physiographic conditions of the formation of a hydrographic network and the hydrological regime of water bodies;
- use theoretical knowledge about the features of the hydrological regime of water bodies, depending on the physical and geographical characteristics of the regions of the Earth;
- carry out the main types of field and office work related to hydrological studies of lakes and reservoirs;
- plan activities for the management, operation and protection of water resources of lakes and reservoirs;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

RBW1221 River basins of the world – 3 credits

Prerequisites: FH1204 Fundamentals of hydrology, PESGK 1210 Physical, economic and social geography of Kazakhstan

Postrequisites: HLR2222 Hydrology of lakes and reservoir, HSER2233 Hydrology of the seas and estuaries of rivers, RSGEC3231 River system and global environmental change.

As result of studying the discipline student be able to:

- to orient in the geographical location of the most significant water objects on the maps of the World and know their basic hydrographic characteristics;
- to know the peculiarities of the formation of river runoff in various physical and geographical regions;
- to have an idea of the main physical-geographical factors that determine the hydrological regime of water bodies of different regions of the Earth;
- to apply theoretical knowledge about the features of the hydrological regime of water bodies and the physical and geographical characteristics of the regions of the Earth for a comparative analysis of natural waters;
- to have an idea of the composition and properties of the hydrosphere, its individual components, the water resources of the planet and its individual parts;
- to understand the responsibility of human use of water resources and the consequences of economic activity;
- to synthesize and analyze geo-hydrological information;
- to distinguish reservoirs and reservoirs according to the hydrological regime, hydrographic characteristics and water management tasks;
- to understand the physical essence and regularities of hydrological processes occurring in watercourses and reservoirs.

Studying topics:

1. Natural conditions for the formation of surface waters in North America. Hydrographic characteristics and hydrological regime of rivers and reservoirs.
2. Natural conditions for the formation of surface waters in Sourth America. Hydrographic characteristics and hydrological regime of rivers and reservoirs
3. Natural conditions for the formation of surface waters in Africa. Hydrographic characteristics and hydrological regime of rivers and reservoirs
4. Natural conditions for the formation of surface waters in Western Europe. Hydrographic characteristics and hydrological regime of rivers and reservoirs
5. Natural conditions of formation of surface waters of Eastern Europe. Hydrographic characteristics and hydrological regime of rivers and reservoirs.
6. Natural conditions of formation of surface waters of Eastern Europe (Ukraine, Belarus, Moldova, the Baltic States).

7. Natural conditions for the formation of surface waters in Eastern Europe (countries of the former USSR and the western region of Russia). Hydrographic characteristics and hydrological regime of rivers and reservoirs

8. Natural conditions for the formation of surface waters in Eastern Europe (countries of the former USSR and the western region of Russia). Hydrographic characteristics and hydrological regime of rivers and reservoirs

9. Natural conditions for the formation of surface waters in Caucasus and European territory of Russia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

10. Natural conditions for the formation of surface waters in Asian territory of Russia (ATR). Hydrographic characteristics and hydrological regime of rivers and reservoirs

11. Natural conditions for the formation of surface waters in East and Central Asia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

12. Natural conditions for the formation of surface waters in South Asia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

13. Natural conditions for the formation of surface waters in South-East and South-West Asia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

14. Natural conditions for the formation of surface waters in Central Asia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

15. Natural conditions for the formation of surface waters in Australia. Hydrographic characteristics and hydrological regime of rivers and reservoirs

16. Natural conditions for the formation of surface waters in Western Kazakhstan. Northern and Central Kazakhstan. Hydrographic characteristics and hydrological regime of rivers and reservoirs

17. Natural conditions for the formation of surface waters in Eastern and South Kazakhstan. Hydrographic characteristics and hydrological regime of rivers and reservoirs

HLR2222 Hydrography of lakes and reservoirs – 3 credits

Prerequisites: PESGK 1210 Physical, economic and social geography of Kazakhstan.

Postprerequisites: WBS2214 Water-balance studies, HPCS3228 Hydrodynamic processes of the Caspian Sea, IRBME4229 Integrated River basin management and Ecohydrology.

As a result of studying the discipline, the student is able to:

- organize a hydrological observation network;
- to monitor the quality of the network of hydrological stations and posts;
- plan activities for the management, operation and protection of water resources of lakes and reservoirs;
- to have an idea of the peculiarities of the hydrological regime of lakes and reservoirs as water bodies of land,

- know the organization, methodology and main directions of hydrological studies of lake water bodies;

- use the calculation methods: balance ratios of the input-expenditure components of the water resources of lakes and reservoirs, their heat, sediments, salts, biogenic elements; surges of water level,

- compare the main methods of assessing the impact of lakes and reservoirs on the environment;

- to organize methodically correctly and at the modern scientific and production level the main field stationary and expeditionary studies, to organize and conduct special hydrological observations; monitor the state of the hydrosphere in real time;

- analyze the collected information and have an idea of the use of hydrometeorological information in various areas of economic activity of the state.

Studying topics:

1. Introduction. Course content, goals and objectives
2. Distribution of lakes and reservoirs on the territory of Kazakhstan, the CIS and the World
3. Classification of lakes by origin. Morphometric characteristics of lakes and reservoirs
4. Hydrometeorological network on lakes and reservoirs
5. Monitoring the water level on lakes and reservoirs
6. Thermal regime of lake similar to reservoirs. Thermal regime of reservoirs
7. Observations of water temperature on lakes and reservoirs
8. Water balance of lakes and reservoirs
9. Ice regime of lake similar to reservoirs
10. Hydrochemical features of water impound
11. Biological features of lakes and reservoirs. The main species of hydrobionts
12. Ecosystems of lakes and reservoirs. Bio productivity. Trophic types of lakes
13. Dynamic phenomena in lakes
14. Water masses of lakes and reservoirs. Bottom sediments of reservoirs. Siltation of reservoirs
15. Integrated use of lakes and reservoirs

PROFILE DISCIPLINES – 33 credits

OBLIGATORY COMPONENT – 6 credits

Module Statistical-mathematical and hydraulic calculations – 6 credits

As a result of studying the module, a student is able to:

- determine the carrying capacity of rivers, canals;
- determine the main dimensions of the cross-section of channels and hydraulic structures;
- analyze the results of calculations to select and justify the final results;
- to make hydraulic calculations to determine the position of the free surface flow curves in rivers and canals with various types of movement in them, calculations of conjugate beefs.
- to estimate the parameters of various laws of distribution, the degree of compliance with empirical and theoretical curves.
- assess the spatial and temporal homogeneity of hydrological data;
- to establish the relationship between the drain and stock-forming factors, as well as to assess the significance of the connections;
- to analyze the perennial runoff fluctuations.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

GRH3223 General and river hydraulics – 3 credits

Prerequisites: GM1203 General meteorology, HM1208 Mathematics, Ph1210 Physics.

Postrequisites: DChF3225 Dynamics of channel flow, ChP3226 Channel processes.

As a result of studying the discipline, the student will be able to:

- demonstrate the basic knowledge and methodological skills of the basic provisions of the laws of equilibrium and fluid motion in rivers and canals, pressure systems;
- demonstrate current knowledge and understanding of the role of hydraulic calculations in solving practical problems related to the use and protection of water resources.
- to set and solve the applied problems of hydraulic calculations in hydrological practice.

- possess methods of hydraulic calculations for rivers, canals, hydrotechnical and hydrometric structures.

- analyze and interpret the results of hydraulic calculations to select and substantiate the final results.

Studying topics:

1. Introduction. Purpose and objectives of the course. Relationship with related disciplines. Main sections of the course. Ideal and real liquid. Hydrostatic pressure. Equations of equilibrium L. Euler.
2. Basic equation of hydrostatics. Pressure at the point. Total hydrostatic pressure on flat surfaces. Center of pressure.
3. Equations of motion L. Euler. Equation of continuity for a fluid flow. The Bernoulli equation for an elementary trickle of an ideal and real liquid
4. Interpretation of the Bernoulli equation. Full head. The Bernoulli equation for the flow of a real fluid
5. Modes of fluid motion. Loss of head. The experiments of Nikuradze and Zeggy. Basic equation of uniform motion.
6. Uniform movement of water in the channels. Formula Chezy. Empirical coefficients of Chezy. Method of permissible speeds
7. Uneven steady-state smoothly changing movement of water in open channels. Differential equation of non-uniform motion.
8. Reduction of the differential equation of non-uniform motion to the form convenient for integration. Demonstrative dependence of Bakhmetev. Integration of the differential equation for prismatic channels.
9. General characteristics of water movement in rivers. The breakdown of the watercourse into the settlement areas. The basic equation of the uneven steady flow of water in rivers.
10. Channel resistance module. Postulate of the invariance of the resistance modulus. The construction of the graph F = f ( ). Methods Pavlovsky N.N to plot the free surface of the stream in rivers.
11. Weirs. Nozzles. Basic calculation formula. Weirs with a thin wall (unprotected and submerged).
12. Weirs of a practical profile (vacuumless, vacuum, weirs with wide thresholds, coefficients of flow, compression, flooding for weirs.
13. Hydraulic jump. The basic equation of a jump. Pairing the tailings.
14. Unsteady movement of water in open channels (UMW). Types of waves.
15. The equations of Saint-Venant. General instructions on the integration of the system of equations of NDE. Integration of the Saint-Venant equations. Features of the motion of the flood waves.

MMSPHI3224 Modern methods of statistical processing of hydrological information – 3 credits

Prerequisites: ICT1105 Information and Communication Technologies, Hyd2206 Hydrometry, HC3207 Hydrological calculation.

Postrequisites: AUHC3217 Assessment of uncertainty in hydrological calculation, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS.

As a result of studying the discipline, the student will be able to:

- collect and process the necessary baseline data for making forecasts;
- analyze the homogeneity of the hydrological series;
- apply the criteria of uniformity and understand the conditions of their applicability;
- have skills in assessing the parameters of various distribution laws, the degree of compliance with empirical and theoretical distribution curves, spatial and temporal homogeneity of hydrological data;
- perform calculations of statistical parameters and assess the reliability of the results;
- own methods of statistical analysis;
- apply statistical models of series of hydrological characteristics.

Studying topics:

1. Random variables and the laws of their distribution. Normal distribution.
2. Theoretical probability distribution curves used in hydrology.
3. Estimation of distribution parameters
4. Statistical testing of hypotheses in hydrological studies
5. Hydrological data homogeneity analysis
6. Testing hypotheses about distribution parameters
7. Linear regression and correlation
8. Multiple linear regression and correlation.
9. Alignment and normalization of curvilinear correlations.
10. Multivariate statistical analysis
11. Check sample rows for randomness
12. Time Series Analysis
13. Investigation of the regularities of fluctuations of the hydrological series
14. Statistical modeling of the annual flow series
15. Statistical modeling of river flow hydrographs

ELECTIVE COMPONENT – 27 credits

Module Channel Processes – 6 credits

As a result of studying the module, a student is able to:

- apply methods for calculating sediment runoff and channel deformations;
- determine the speed of the predicted channel deformations taking into account the types of channel processes.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

DChF3225 Dynamics of channel flow - 3 credits

Prerequisites: HM1208 Higher Mathematics, GRH3223 General and river hydraulics.

Post requisites: ChP3226 Channel processes, IMP4232 Introduction to mudflow processes, GARBM4230 Geomorphological approach to river basin management.

As a result of studying the discipline, the student is able to:

- to know modern theories describing the processes occurring in open turbulent flow of water;
- possess basic knowledge and methodological skills in analyzing current problems in the water resources field;
- analyze the role of the main formation factors of channel processes.

the expected deformations and taking into account the interaction of engineering structures;

- determine the need for changes in the water management field;
- analyze the dynamics of solving scientific problems of the course (scientific reviews of the research of a specific problem).

Studying topics:

1. Introduction. Course content, stages of development of the discipline. Practical value. The purpose and objectives of the course. Methods of research and communication with related disciplines.

2. Laminar regime of flow. O. Reynolds experiments. Laminar flow movement of a viscous fluid in cylindrical tubes. The plot of speeds. Poiseuille formula. Laminar regime of flow - whirling. Properties of vortices in a fluid.

3. Turbulent regime of flow. The instability of the laminar regime of flow. The occurrence of turbulence. Instruments for measuring the velocity of turbulent flow. Pulsation of current speed. Longitudinal averaged speed.

4. Characteristics of turbulence. Pulsation of the longitudinal component of the current speed. The intensity of turbulence. Pulsation of the vertical component of the current speed.

5. Kinetic energy of turbulent flow. Turbulent flow energy. The kinetic energy of a turbulent flow. Adjustments to the kinetic energy of the turbulent flow.

6. Turbulent shear stresses in the averaged flow. Model of averaged turbulent flow. Turbulent shear stresses. Their physical nature. L. Prandtl formula for turbulent shear stresses. T. Karman and Taylor hypotheses.

7. Wall mounted boundary layer. The initial section of the channel. Laminar and turbulent boundary layers. Determination of the extrusion thickness of the boundary layer.

8. Distribution of averaged velocities over the depth of a uniform turbulent flow. Laminar motion case (velocity distribution in a laminar sublayer). The velocity distribution in the near boundary wall layer. The distribution of velocities in the main layer of the turbulent flow.

9. Elements of the statistical theory of turbulence. Cascade scheme of turbulence. Correlation functions of communication, point-to-point and one-point moments of connection. Correlation coefficient. Scales of turbulence.

10. Statistical characteristics of turbulence. Algorithm for calculating the turbulent characteristics of the time series. Theory of locally isotropic turbulence A.N. Kolmogorov.

11. The laws of resistance of non-pressure flow of water. Two types of calculated dependencies. The relationship of the coefficients of resistance. Summary graph of resistance. Zones and areas of resistance. Resistance of bottom channel forms.

12. The structure of the turbulent averaged flow over the ridges. Cases of perfect and real fluid. Two types of flow around the ridges.

13. Crisis flow; graph of changes in the law of resistance of the ridge. Changes in the relationship between flow rates and water levels in rivers at different phases of the water regime. The case of shallow depths.

14. The interaction of the channel and floodplain flows. Typification of interaction processes. Speed field and carrying capacity of floodplains.

15. Influence of floodplain flow on costs and average flow rates. Accounting for the effect of interaction between the channel and floodplain flows in the calculations of capacity.

ChP3226 Channel processes - 3 credits

Prerequisites: HM1208 Higher Mathematics, GRH3223 General and river hydraulics DChF3225 Dynamics of channel flow.

Post requisites: IMP4232 Introduction to mudflow processes.

As a result of studying the discipline, the student is able to:

- perform calculations of a given channel process for the purpose of forecasting
- demonstrate modern knowledge and understanding of the role of channel processes and solid river runoff in the erosion-accumulative activity of water bodies;
- to carry out, for solving specific problems of practice, the formulation of experimental (full-scale and laboratory) studies of channel processes;
- to interpret the features of the interaction of the channel flow and sediment, the main types of channel processes.

Studying topics:

1. Introduction. Course content, stages of development of the course. The idea of the channel process. Practical value. The purpose and objectives of the course. Methods of research and communication with related disciplines.

2. Fundamentals of the hydromechanical theory of channel processes. Two theories of channel processes: hydromechanical and hydromorphological. The interaction of particles and flow; channel bed and flow.

3. The main characteristics of river soils (bottom sediments). Sediment source material, mechanical characteristics of soils, sediment abrasion. Granulometric curves, characteristic particle sizes.

4. Hydraulic size of sediment. Background: Stokes, Allen, Creil, A.P. Zegzhda, B.V. Arkhangelsky and others. The regime of sediment deposition. The scale of hydraulic size by V.V. Romanovsky.

5. Hydraulic strength of bottom sediments. Background Mechanical (power) effect of flow on a separate soil particle. Empirical formulas for determining the initial rate of particle shift: V.N. Goncharov, G.I. Shamov, I.I. Levi, V.S. Kyoroza.

6. The theory of suspended sediment by a turbulent flow of water. History. General description of the weighing process. Plot of turbidity. Semiempirical (diffusion) weighing theory: The Taylor-Schmidt Idea.

7. Interchange of turbulent suspended flow and sediment bed. Bottom turbidity, turbidity soar. Determination of the average turbidity of the weighing stream. Sediment consumption.

8. Elements of sediment attraction theory. Methodology A.V. Karaushev to determine the stability of bottom sediments. Determination of sediment load; empirical formulas G.I. Shamov, V.G. Goncharov, I.I. Levy and others. Consumption of bottom-bed movement of sediment.

9. Hydromorphological theory of channel processes. General description of the theory. Discreteness of channel processes. Forms of channel processes: micro, meso and macro forms. Reversible and irreversible processes.

10. Microforms: Generalization of laboratory results. Classification charts N.S. Znamenskaya and others.

11. Mesoforms. Belt ridges: conditions of formation, gauges, field detection methods, hydraulics of the flow of belt ridges, direct and indirect movement of the ridges. Mesoform channel topography: formation conditions, gauges, flow hydraulics. Alluvial sediment: conditions of education, river bifurcation, multi-channel riverbed.

12. Macro forms. General description. Bend gauges, floodplain, floodplain morphology. Floodplain flooding coefficient.

13. Limited meandering. Formation conditions, the formation of the coastal shaft, watering, hydraulics flow around the floodplain and shallows. The offset bends.

14. Free meandering. Conditions of education. Phases of development of a bend: loop-shaped and ovoidal bends. Fans of moving and restoring the history of the river meandering.

15. Unfinished meandering. Floodplain branches. Criteria for the transition from one to another form. Morphometric formulas. Features of channel processes on Mountain Rivers.

Module GIS technology in hydrology - 6 credits

As a result of studying the module, a student is able to:

- to be guided in the circle of tasks solved with the help of GIS, to effectively use GIS in the process of hydrological research;
- possess the skills of modeling physical situations using a computer.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

GISH3228 GIS in Hydrology – 3 credits

Prerequisites: ICT1105 Information and Communication Technologies; MMSPHI3224 Modern methods of statistical processing of hydrological information.

Postrequisites: MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling, MMGFT4232 Mathematical modeling of the groundwater flow and transport.

As a result of studying the discipline student is able to:

- define terminology related to hydrological geo-information systems and apply it in the researching of hydrological processes;
- describe the purpose and features of the GIS, the stages of building a GIS and their structure;
- explain the composition, nature and condition of the main hydrological problems and methods for their solution using GIS technologies;
- apply applied GIS programs, user interface and the principle of working with GIS tools for studying hydrological processes and determining the main hydrological characteristics;
- analyze and apply the methods of GIS technologies for the study of hydrological processes;
- to master the existing methods of obtaining vector and raster images, modeling of hydrological processes and their prediction using GIS-technologies;
- to formulate general principles for constructing data models in GIS and creating thematic maps for hydrological purposes;
- to characterize fundamental research and contemporary problems in the field of hydrological science;
- integrate the knowledge gained in analyzing the regime of water bodies, calculating hydrological characteristics, modeling and forecasting hydrological processes using GIS technologies.

Studying topics:

1. General information about geographic information systems. Generalized functions of GIS systems. GIS classification. Data sources and their types. Sectoral use of GIS.

2. The main components of GIS. Hardware (technical) tools. Software. Information Support.

3. Data in GIS. Spatial elements. Description of spatial elements.

4. Ways to represent geographic space. Data models Vector models.

5. Raster models. Spatial resolution of raster images. Comparison of the representation of spatial elements in raster and vector data models.

6. Data Formats. Vector data formats. Raster data formats.

7. Database and management. Hierarchical database model. Network Model DB. DB relational model. Object-oriented database model.

8. Data entry technologies. Methods of data entry. Conversion of source data. Remote sensing data entry.

9. Analysis of spatial data. Tasks of spatial analysis. The main functions of spatial data analysis. Analysis of the spatial distribution of objects.

10. Modeling surfaces. Surface and digital model. Data sources for the formation of a DEM. Data structure for rendering surfaces. Interpolation.

11. The technology of building digital elevation models. The main processes. Requirements for process accuracy. Use of DEM.

12. Methods and visualization tools. Electronic maps and atlases. Cartographic ways to display results and display data. 3D visualization.

13. Stages and rules for designing GIS.

14. Map as a model of geographic data. Changing the paradigm in cartography. Cartographic projections. Coordinate system for cartography. Cartographic process. Cartographic symbols.

15. Additional software modules for modeling hydrological processes. Spring flood, Risk of emergencies, Breakthrough of the GTS, Flooding of territories.

MHPGIS4227 Modeling of hydrological processes in GIS – 3 credits

Prerequisites: HP2233 Hydrological processes, HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological information, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts,

Postrequisites: no.

As a result of studying the discipline student is able to:

- demonstrate the knowledge and understanding of hydrological laws;
- justify the construction of hydrological models, interpret the results;
- demonstrate an understanding of the general structure of hydrological models and relationships of its elements;
- describe and explain the essence of the construction of hydrological models;
- use hydrological models in individual or group teaching and research activities;

- analyze the dynamics of solving scientific problems of the course - investigate the whole mechanism for building a hydrological model;

- understand the principles of deterministic stochastic modeling;

- use stochastic modeling systems in hydrological tasks.

Studying topics:

1. Introduction to modeling of hydrologic processes
2. Mathematical modeling from the points of view of mathematics and hydrology. Purposes of modeling. Model types
3. Principles of modeling system creating
4. Violations of modeling basic laws
5. Physical validity of the hydrological models
6. Main problems of modeling
7. Validation of models
8. Deterministic modeling of flow formation processes
9. Modeling of slope erosion and pollution
10. Modeling of dangerous hydrological phenomena
11. Mathematical statistics in hydrology
12. Stochastic modeling in hydrology
13. Stochastic modeling system. Fundamentals
14. Stochastic modeling system. Preparation of baseline data and assessment of parameters
15. Deterministic-stochastic modeling

Module Hydrological support of the Economy - 6 credits

As a result of studying the module, a student is able to:

- determine the influence of the wastewater on the water quality of water bodies

- apply the knowledge gained to clean the wastewater and prevent the discharge of water into water bodies with indicators of quality above the maximum permissible norms, while monitoring the status of surface water quality;

- describe measures to reduce the discharge of polluted substances into water bodies;

- monitor the effectiveness of water conservation measures.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

HSWC4229 Hydrological services for the water consumers – 3 credits

Prerequisites: AUHC3217 Assessment of uncertainty in hydrological calculation, EWRM 3219 Economics of water resources management, HF3216 Hydrological forecasts.

Postrequisites: no.

As result of studying the discipline student be able to:

- to have basic knowledge and methodological skills on the analysis of current problems in the use of data on water resources;
- demonstrate current knowledge and understanding of the role of hydrological information in the national economy;
- analyze the economic effectiveness of the use of hydrological information;
- take into account the influence of hydrometeorological conditions on the activities of various sectors of the national economy;
- apply principles and methods of searching for optimal economic solutions using hydrological information;
- develop recommendations to consumers on the most beneficial use of the hydrological data obtained;
- determine the need for changes in the use of hydrological information, depending on the objectives and conditions of the consumer in accordance with the content and tasks;
- synthesize, interpret the results of the training of the discipline.

Studying topics:

1. The subject of study and the place of hydrometeorology in the sphere of material production
2. Organizational bases for the interaction of the RSE" Kazhydromet "with the main consumers, ministries and departments
3. Regular hydrological information. Hydrological network of observations. Information posts. New types of hydrological information
4. Episodic hydrological information. Emergency hydrological information. Regime and normative hydrological information. Prognostic hydrological information. Types of prognostic information
5. Forms of release of hydrological forecasts. A warning about the threat of an elemental hydrological phenomenon. Hydrological forecasts using aerospace information. Recommendations on the accounting or use of the expected state of water bodies in the activities of state institutions and commercial structures.
6. Search for an optimal economic solution based on normative and predictive information. The concept of "loss" (damage). Properties of loss functions
7. Criteria for optimizing economic decisions. Minimization of average losses.
8. The conditional probability matrix. Optimization calculation in matrix form.
9. Economic efficiency of hydrometeorological support of the national economy. Potential Utility of Hydrometeorological Information.
10. General principles of calculation of economic efficiency of application of hydrological forecasts. Economic efficiency of the use of normative information.

11. Analysis of methods for assessing the economic effectiveness of hydrometeorological support in the energy sector

12. Analysis of methods for assessing the economic effectiveness of hydrometeorological support in the water sector, land improvement and water transport

13. Analysis of methods for assessing the economic effectiveness of hydrometeorological support in agriculture and forestry, in the timber industry

14. Analysis of methods for assessing the economic effectiveness of hydrometeorological support in fisheries, rail and road transport

15. Analysis of methods for assessing the economic effectiveness of hydrometeorological support in industry and municipal services

WASSWT4230 Water abstraction supply, sanitation and wastewater treatment – 3 credits

Prerequisites: HC2213 Hydrochemistry; HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management, UH3231 Urban hydrology.

Postrequisites: no.

As a result of studying the discipline, the student is able to:

- identify wastewater in domestic and industrial conditions;
- compare the physico-chemical indicators of the main sources of pollution;
- know the definition of the required degree of purification of wastewater;
- identify the general theoretical foundations of practical methods for purifying wastewater and the conditions for applying each method;
- predict the choice of methods for purifying wastewater, depending on the degree of contamination and the composition of wastewater;
- evaluate wastewater sludge utilization methods;
- to classify the main structures of sewage treatment plants and their effectiveness;
- know the conditions of release of wastewater into water objects;
- know about the calculations based on the simplest treatment facilities

Studying topics:

1. Goals and objectives of the course. The current state of the quality of surface waters of the Republic of Kazakhstan. Ways to reduce water pollution.
2. Wastewater, their types by origin. Characteristic wastewater.
3. Natural and wastewater. Water quality indicators.
4. The composition of wastewater. Determination of the concentration of pollutants. Water quality assessment.
5. Requirements for water quality. Drainage systems.
6. Standards and wastewater costs. The coefficients of uneven receipt of the wastewater treatment plant.
7. Conditions for lowering the wastewater into the city sewer and into water objects.

8. Influence of water resources on water quality in water objects. Self-purification. Mixing and dilution.

9. Calculations of mixing the polluted stream with the water of water objects.

10. Rationing of water quality in water objects. Requirement for cleaning wastewater.

11. Determination of the required degree of purification of wastewater.

12. Methods for cleaning wastewater, the conditions of their use.

13. Mechanical wastewater treatment.

14. Biological treatment of wastewater. Natural biological treatment.

15. Artificial biological treatment of wastewater.

Module Dangerous hydrological phenomena and hydrology of the seas – 9 credits

As a result of studying the module, a student is able to:

- manage hazardous hydrological processes;
- reproduce the calculations and forecasts of hydrological hazards;
- determine flood damage, speed of movement of the flood;
- to compile data on mudflow phenomena in the territory under consideration;
- organize the study of mudflow basins and mudflows;
- to make calculations to justify the protection of buildings and activities;
- evaluate mudflow hazard;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

WRNH3231 Water-related natural hazard - 3 credits

Prerequisites: GM1203 General meteorology, HM1208 Higher Mathematics, HR1205 Hydrology of rivers, HELR2218 Hydraulic engineering and land reclamation, HSER2233 Hydrology of the seas and estuaries of rivers.

Postrequisites: IMP4232 Introduction to mudflow processes, IRBME4229 Integrated River basin management and Ecohydrology, GARBM4230 Geomorphological approach to river basin management, ECCWM4232 Effects of climate change on watershed management.

As a result of studying the discipline, the student is able to:

- know the types of floods and the classification of floods by frequency, the nature of long waves, as the cause of floods; risks and damages from water-related natural hazard,

- distinguish between direct and indirect damages from floods; spring floods and mash-blocking phenomena, floods of storm origin, mudflows and mudflow types, avalanches and their hydrological role, the influence of endogenous factors (tsunami, surges); issues of hydrological information interpretation, calculation and forecasting of hazardous phenomena,

- understand the features of hydrological problems associated with dangerous hydrological phenomena: their nature, nature of manifestation, risks and damages from their manifestation,

- issues of forecasting and calculating the characteristics of floods; determine the speed of movement of the flood, manage dangerous hydrological processes and understand the issues of calculating and forecasting dangerous hydrological phenomena,

- apply basic methodological approaches to their solution,

- analyze the collected information, develop measures to reduce the risks and damages from water-related natural hazard; give an economic assessment of the effectiveness of water management measures,

- to organize methodically correctly and at the modern scientific and production level and to conduct basic field stationary and expeditionary studies to study the causes of flooding, damage assessment from water-related natural hazard,

- to be able to objectively assess their achievements, to analyze the situation; to realize the need to form new methods of collecting and interpreting hydrological information, further personal and professional development; to determine the most effective areas of application of their abilities, to promote the development of society, etc.

- to formulate problems, goals and objectives for the study of the nature of dangerous hydrological phenomena; make organizational decisions, draw conclusions, argue, substantiate, insist on their point of view, make decisions, convince opponents, etc.

Studying topics:

1. Catastrophic hydrological phenomena in nature
2. Long waves
3. Risks, damages from hydrological hazards
4. Floodplain
5. Spring flood. Movement of the flood wave
6. Ice matter phenomena
7. Storm floods
8. Mudflows
9. Mudflows in Kazakhstan
10. Snow avalanches, their hydrological role
11. The endogenous phenomena.
12. The surges outset phenomena.
13. The concept of managing hydrological processes
14. Issues of interpretation of hydrological information regarding hazardous hydrological phenomena

15. Issues of forecasts and calculations of the characteristics of hazardous hydrological phenomena

IMP4232 Introduction to mudflow processes - 3 credits

Prerequisites: GM1203 General meteorology, HFS3215 Hydrological field survey, DChF3225 Dynamics of channel flow, ChP3226 Channel processes, WRNH3231 Water-related natural hazard.

Postrequisites: no.

As a result of studying the discipline, the student is able to:

- organize the study of mudflow basins and mudflows;
- summarize data on mudflow phenomena in the territory under consideration;
- evaluate mudflow hazard;
- apply the basic methods of calculating the parameters of mudflows;
- apply the assimilated principles of mudflow forecasting;
- make calculations to justify the protection of buildings and activities;
- own the essence and assess the state of the mudflow problem of the territory in question;
- apply all types and devices of riverbed water-protecting hydraulic structures;
- understand the features of the current state of the mudflow hydrometry and other methods of studying mudflows;
- possess the principles of approach to the development and implementation of a set of anti-village measures.

Studying topics:

1. Definition of the concept of a mudflow. Characteristic signs of it in contrast to the water flow. Basic terminology in studying mudflows.
2. The destructive effect of mudflows. Classification of mudflows. Brief history of mudflow researches.
3. Formation of mudflows. Major mudflows formation factors. The main types of mudflow processes. The concept of mudflow focus. The classification of mudflow focuses.
4. The formation of water flow of mudflows. The formation of a solid part of the mudflow. Models of processes of mudflow formation.
5. Mudflow regime. Repeatability of mudflows. The duration of the mudflows. Mudflow dynamics.
6. Organization and carrying out field studies on mudflows.
7. Methods of observation and measurement in surveying mudflow basins.
8. Determination of the main elements of mudflows by the results of observations. Determination of mudflow density, flow velocity, flow discharges and volumes of mudflows.
9. Systematization of survey materials and observations conducted by mudflow stations. Compilation of the “Catalog of mudflow basins and focuses in the territory of the CIS”, “Materials of observation of the mudflow station”, etc.
10. Calculation methods for determining the hydraulic elements of mudflows. Density and speed of mudflow mass.

11. Calculation of the maximum discharges of mudflows of storm and glacial origin.

12. Determination of maximum discharges by left traces. Determination of mudflow volumes.

13. Existing methods for estimating mudflow hazards and prediction of mudflows. Mudflow hazards warning service.

14. The essence, composition and types of anti-mudflow activities. Mudflow activities in the Ile Alatau. Structures of anti-mudflow facilities. Prevention activities to prevent mudflows

15. Mudflows in the territory of Central Asia and Kazakhstan. The mudflow activity of the Ile Alatau. Description and parameters of outstanding mudflows in Ile Alatau.

HSER2233 Hydrology of the seas and estuaries of rivers – 3 credits

Prerequisites: FH1204 Fundamentals of hydrology, HPh2212 Hydrophysics, RBW1221 River basins of the world.

Postrequisites: WRNH3231 Water-related natural hazard, HPCS3228 Hydrodynamic processes of the Caspian Sea.

As a result of studying the discipline, the student is able to:

- know the physical-chemical properties and features of the ocean (sea) water;
- know the basic processes occurring in the oceans and seas;
- know the features of the processes occurring in the zone of interaction of sea and continental waters;
- know the principles for obtaining baseline information on the hydrological regime of the ocean and seas;
- know the main marine objects, their position on the globe (using silent or small-scale maps);
- apply, if necessary, the knowledge gained for the correct interpretation of hydrological information;
- make the necessary calculations of marine hydrological characteristics and the corresponding graphical constructions.
- evaluate the resources of the oceans and the prospects for their use;
- to solve the environmental problems of the oceans and seas;
- analyze the interaction of the ocean and the atmosphere;
- be able to use the main instruments and methods for measuring marine hydrological characteristics.

Studying topics:

1. Oceans, its study
2. The origin of the ocean. Ocean bed.
3. The interaction of the ocean and atmosphere
4. Biological processes in the oceans and seas
5. Basic physical characteristics of ocean waters
6. The main thermal characteristics of seawater
7. Ocean heat balance

8. Composition of seawater. Salinity. Density. Ice
9. Ocean water masses
10. Circulation of waters. Currents
11. Tides
12. Waves in the ocean
13. Seishi. Tsunami
14. Wellhead area of the river
15. Features of the hydrological regime of the mouth area.

Module Computer technologies in hydrology – 6 credits

As a result of studying the module, a student is able to:

- be able to independently acquire new knowledge, use modern information tools and technologies;
- use modern methods for assessing the elements of the water balance of water bodies, make and solve the equations of water, warm and salt balance in the territory of river basins; apply the methods of geodetic works and satellite images of remote sensing of the territory to solve the problems of assessing the morphometric and hydraulic characteristics of watercourses.
- to compare the laws of the processes occurring in the hydrosphere, to know the modern concepts of the development of hydrological science; have an idea of fundamental research and current problems in the field of hydrometeorological science;
- apply the basic methods of calculation of river flow and be able to use them in the presence of reliable observation materials and in their absence.
- make hydrological forecasts, substantiate methods for determining pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to draw up professional information provided by both specialists and non-specialists;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

HM4227 Hydrological modeling - 3 credits

Prerequisites: FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS, MMGFT4232 Mathematical modeling of the groundwater flow and transport.

Postrequisites: no.

As result of studying the discipline student be able to:

-overview of hydrological processes (rainfall, infiltration, evapotranspiration, percolation, precipitation, surface runoff)

-hydrological models types (conceptual, distributed)

-modules of models

-data preparation for model input

-time series analysis of meteorological data for plausibility test

-calibration of hydrological models

-validation of hydrological models

-interpretation of hydrological model results

- application of hydrological model results

Studying topics:

1. Introduction into subject and general overview into hydrology
2. Introduction into hydrological modeling; conceptual and distributed model types
3. Introduction into different modules of hydrological models
4. Review of existing hydrological models and their application fields
5. Temporal and spatial resolution of hydrological models
6. Solid and liquid precipitation
7. Role of glaciers in mountain hydrology
8. Role of snow in hydrology
9. Evapotranspiration, infiltration and percolation
10. Introduction into calibration of hydrological models
11. Introduction into validation of hydrological models
12. Climate impact assessment using hydrological models
13. River routing approaches and their use in models
14. Evapotranspiration, infiltration and percolation
15. Sensitivity analysis of hydrological parameters

HPCS3228 Hydrodynamic processes of the Caspian Sea - 3 credit

Prerequisites: HPh2212 Hydrophysics, HLR2222 Hydrography of lakes and reservoirs, HSER2233 Hydrology of the seas and estuaries of rivers.

Postrequisites: no

As result of studying the discipline student be able to:

- to work competently with information, to do necessary generalizations, conclusions, to determine consis tent patterns, to analyze;
- to reason results, the researches conducted by him and to discuss scientific problems;
- to apply the knowledge and to solve problems of forecasting of dynamic processes on the Caspian Sea;
- to conduct ekmperiment independently and to explain the causes of these or those phenomena;

- to unite results of the researches in a whole and to present them to scientific community.

Studying topics:

1. Course content, tasks and stages of development of discipline. Long-term and inter-annual Caspian Sea level fluctuations.

2. Storm surges fluctuations and upwelling/down welling. Major factor determining dynamics of storm surge fluctuations.

3. Basic components of water balance of the Caspian Sea and their changes in time.

4. Basic principles of marine hydrometeorological forecasting. Subjects to sea hydrometeorological providing and factors influencing them. Purposes and tasks.

5. Basic principles of work of hydrodynamic model MIKE 21. Main Equations. Use of Caspian Sea Hydrodynamic Model.

6. Basic principles of work of wave spectral model SWAN.

7. Methods of studying of ice conditions at the seas. Statistical characteristics of the ice regime. Types of coastal observations of an ice cover on the Caspian Sea. Use of data of remote sensing for the analysis of an ice situation.

Module Integrated water resources management - 6 credits

As a result of studying the module, a student is able to:

- have an idea of the role of hydrology in related geosciences, the application of hydrometeorological information in various fields of economic activity of the state.

- make hydrological forecasts, substantiate methods for determining pollution of water bodies, make hydrological calculations and analysis of the results, be able to draw up professional information provided by both specialists and non-specialists.

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

IRBME4229 Integrated River basin management and Ecohydrology – 3 credits

Prerequisites: WBS2214 Water balance studies, ESD2110 Ecology and sustainable development, EWRM 3219 Economics of water resources management, HLR2222 Hydrography of lakes and reservoirs, HSWC4229 Hydrological services for the water consumers, WRNH3231 Water-related natural hazard, RSGEC3231

River system and global environmental change, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment.

Postrequisites: no

As a result of studying the discipline, the student will be able to:

- demonstrate the basic knowledge and methodological skills of assessing impacts on river basins in an integrated manner, honoring the principal of multi-functionally of rivers and their landscapes;
- demonstrate current knowledge and understanding of the role stakeholders and their use of the water resources for the protection of water resources.
- to analyze and solve applied problems in integrated river basin management in hydrological practice.
- possess methods of visualization, analysis and assessment of impacts and threats in river basins
- analyze and interpret the results of ecohydrological calculations to evaluate possible management and mitigation strategies.
- to constructive educational and social interaction and cooperation in the group;
- to propose for consideration the problem, to argue its importance;
- to take criticism and criticize;
- work in a team;
- to communicate in an adequate manner with different stakeholders in a river basin;
- to assess the significance of the results of the design study in its own professional development and in the development of the scientific paradigm of integrated river basin management and ecohydrology.

Studying topics:

1. Introduction to principles of integrated river basin management
2. Basics of multi-functionality of river basins.
3. Key stakeholders in river basin management
4. Point source and non-point source pollution of rivers
5. Pressures from agriculture, urban and industrial areas
6. Principals of freshwater ecosystems
7. Aquatic species and their habitats
8. Basics of Ecohydrology
9. Dual regulation.
10. Nature-based solutions
11. Mitigation and management strategies for river basins
12. River basin models and decision support tools
13. The NEXUS approach
14. Introduction into the SWAT model.
15. Applications of the SWAT model for river basin management.

GARBM4230 Geomorphological approach to river basin management – 3 credits

Prerequisites: GC1211 Geodesy and Cartography, HFS3215 Hydrological field survey, DChF3225 Dynamics of channel flow, WRNH3231 Water-related natural hazard.

Postrequisites: no.

As result of studying the discipline student be able to:

1. Demonstrate an understanding of the impact of changing climate and land-use on river basin dynamics.

2. Demonstrate an understanding of the procedures used in geomorphological assessments of river basins.

3. Evaluate and explain the causes of river instability and identify what steps can be taken to alleviate it.

4. Perform a desk study, using a GIS, identifying the safest route of a pipeline across a river valley

Studying topics:

1. Principles of fluvial geomorphology for river basin managers
2. Framework and procedures for geomorphological assessment
3. Climate change and river basin management
4. Estimating flood risk
5. Sediment slugs and river instability
6. Impact of metal mining on river systems
7. Mine tailings dam failures and river restoration
8. Protecting and managing cultural resources in river basins
9. Seminar presentations on river crossings project

Module Impact of climate change and anthropogenic load on river runoff - 9 credits

As a result of studying the module, a student is able to:

- compare the laws of the processes occurring in the hydrosphere, to know the modern concepts of the development of hydrological science; have an idea of fundamental research and current problems in the field of hydrometeorological science;

- make hydrological forecasts, substantiate methods for determining pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to draw up professional information provided by both specialists and non-specialists;

Methods for evaluating the results achieved:

summative assessment, criterial evaluation by:

1) oral survey: colloquium, exam;

2) written work: test, test, laboratory and settlement and graphic work;

3) control using technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory works, testing by exam, educational tasks on specialized programs;

4) innovative assessment tools: portfolio, business (role-playing) game, project method, method of successive situations.

RSGEC3231 River system and global environmental change – 3 credits

Prerequisites: WBS2214 Water balance studies, HF3216 Hydrological forecasts, RBW1221 River basins of the world.

Postrequisites: IRBME4229 Integrated River basin management and Ecohydrology.

As a result of studying the discipline, the student is able to:

- familiarize with the problems of some river systems of Western Europe, North America and Africa;
- have an idea of the solution of problems and the application of methods of using river systems in various regions of the World;
- understand the technological capabilities in solving problems of management of basin systems;
- to form an understanding of the ongoing environmental problems in some river systems;
- evaluate flood control methods in the USA and the UK.

Studying topics:

1. River systems of Great Britain and Northern Europe, their problems and solutions
2. River systems of the Mediterranean I, their problems and solutions
3. River systems of the Mediterranean II, their problems and solutions
4. River systems of Great Britain and Northern Europe I, their problems and solutions
5. River systems of Great Britain and Northern Europe II, their problems and solutions
6. River systems of North America, their problems and solutions
7. African river systems, their problems and solutions
8. Flood Stories in the UK and North America
9. Methods of protection against flooding.
10. Impact of metal extraction on river systems

ECCWM4232 Effects of climate change on watershed management – 3 credits

Prerequisites: WBS2214 Water balance studies, HSWC4229 Hydrological services for the water consumers, WRNH3231 Water-related natural hazard.

Postrequisites: no

As result of studying the discipline student be able to:

- know changes in flow regimes and reduce the annual availability of water;
- to know the consequences of the use of water resources in the main sectors of the economy, in particular, agriculture, forestry, energy;
- take into account the requirements of industries in the provision of water;
- apply methods of efficient use of water resources with regard to environmental requirements;
- develop water balances for river basins,

- justify the environmental consequences of the use of surface waters;
- harmonize the requirements of different sectors of the economy to water resources and water sources;
- understand the features of water management calculations;
- carry out calculations of the regulation of the flow of reservoirs in order to determine their main parameters;
- give an economic assessment of the effectiveness of water management measures.

Studying topics:

1. Introduction to water resources systems
2. Water resources assessment: methods and tools
3. Water uses & water demands
4. Water planning and governance
5. Water resources management tools
6. Extreme events: floods and droughts
7. Introduction to climate change
8. Climate models
9. Socioeconomic and climate scenarios
10. Climate change impacts and assessment
11. Climate change impacts on water quantity
12. Climate change policy: mitigation and adaptation
13. Adaptation approaches/dealing with uncertainty
14. Adaptation measures in the agricultural sector
15. Adaptation measures in the urban sector

PPMTRK2233 Problem of pollutions of the main transboundary rivers of Kazakhstan – 3 credits

Prerequisites: HC2213 Hydrochemistry, ESD2110 Ecology and sustainable development, EWRM 3219 Economics of water resources management.

Postrequisites: AAIWR4220 Assessment of anthropogenic impacts on water runoff

As a result of studying the discipline, the student will be able to:

- to describe natural patterns and processes of hydrochemical regime formation of river;
- to understand basic principles of methods of hydrochemical and hydroecological calculations;
- to know methods of mathematical statistics in solving computational problems;
- to apply known algorithms for calculating hydrochemical and hydroecological characteristics in different hydrological periods: flood and low-water;
- to carry out calculations of hydrochemical characteristics and analyze results;
- to have an idea of interannual distribution of hydrochemical characteristics;

- to own methods of seasonal distribution of hydrochemical regime;
- to apply skills of producing computational and graphical works with modern tools and methods;
- to evaluate results and recommendations for solution of ecological problems.

Studying topics:

1. Introduction. Course content, tasks and stages of development of discipline
2. Regime and characteristics of conditionally natural hydrochemical flow in the Ertis river basin
3. Transformation of water chemical composition of the Ertis river
4. Hydrochemical characteristics of rivers of the Balkash-Alakol basin in conditionally natural flow period
5. Transformation of chemical composition in the Balkash-Alakol basin
6. Regime and characteristics of conventionally-natural hydrochemical runoff in the Aral-Syrdariya basin
7. Transformation of chemical composition in the Aral-Syrdarya basin
8. Regime and characteristics of natural flow in the Zhaiyk-Caspian (Ural-Caspian) basin
9. Transformation of chemical composition in the Zhaiyk-Caspian (Ural-Caspian) basin
10. Hydrochemical characteristics of rivers in the Yesil river basin in conditionally natural period
11. Transformation of chemical composition of the Yesil river
12. Hydrochemical characteristics of rivers of the Tobyl river basin during period of conditional-natural flow
13. Transformation of chemical composition of the Tobyl river
14. Hydrochemical characteristics of rivers of the Shu-Talas basin during period of conditional-natural flow
15. Transformation of chemical composition of the Shu-Talas basin

Module Mathematical modeling of hydrogeological processes and applied issues of hydrology – 9 credits

As a result of studying the module, student able to:

- be able to independently acquire new knowledge, use modern information tools and technologies;
- use modern methods of assessing the elements of the water balance of water bodies, compose and solve the equations of water, warm and salt balance in the territory of river basins; apply methods of geodetic work and satellite imagery of remote sensing of the territory to solve problems of assessing the morphometric, hydraulic characteristics of watercourses.
- to compare the regularities of the processes occurring in the hydrosphere, to know the modern concepts of the development of hydrological science; to have an idea of fundamental research and current problems in the field of hydrometeorological science

- apply the basic methods of calculating river flow and be able to use them in the presence of reliable monitoring materials and in their absence.

- be able to produce the main types of hydrometeorological observations and works, perform processing of observation materials and prepare them for publication, master modern methods of collecting, processing and analyzing hydrometeorological information

- make hydrological forecasts, justify the methods for determining the pollution of water bodies, make hydrological calculations and analysis of the results obtained, be able to design professional information that is presented to both specialists and non-specialists;

Methods for evaluating the results achieved:

1) oral survey: interview, colloquium, exam;

2) written work: test, essay, abstract, laboratory and settlement and graphic work;

3) control with the help of technical means and information systems: computer testing programs, complex situational tasks; virtual laboratory work, exam testing, educational tasks on specialized programs;

4) innovative assessment tools: case-method, portfolio, business (role-playing) game, debate, discussion, project method, incident method, method of successive situations, etc.

UH3231 Urban hydrology – 3 credits

Prerequisites: EWRM3219 Economics of water resources management.

Postrequisites: AAIWR4220 Assessment of anthropogenic impacts on water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment.

As a result of studying the discipline, the student will be able to:

- understand the key concepts of urban hydrology, water management of surface and groundwater in an urban environment;

- compare and contrast natural and urban water cycles;

- plan, according to estimates of precipitation (storms), the amount of urban runoff in different urban areas,

- understand the basics of hydraulics of urban buildings;

- develop stormwater systems and evaluate their reliability;

- understand the effects of snow and ice in the maintenance of urban structures;

- understand the causes of various types of urban flooding;

- create flood risk maps;

- be aware of water quality problems associated with urban runoff;

- take into account the ecological infrastructure and other methods of natural drainage to increase water retention in the built environment;

- own methods of improving water quality in cities;

- understand the risk of soil erosion and the fight against this phenomenon;

- understand the impact of climate change on urban hydrology, and take this into account when designing an urban water system;
- use computer-aided design of various types in urban hydrology.

Studying topics:

1. Introduction to urban hydrology
2. Storm water quantity
3. Overview of storm water system design
4. Introduction to design programs: AutoCAD
5. Introduction to design programs: SWAM
6. Green infrastructure in urban hydrology
7. Flood control and climate change in urban hydrology
8. Urban hydrology in cold climate
9. Water quality issues in urban rivers and groundwater
10. Urban runoff case studies

MMGFT4232 Mathematical modeling of the groundwater flow and transport – 3 credits

Prerequisites: FH1204 Fundamentals of hydrology, HM1208 Higher Mathematics, WBS2214 Water-balance studies, GISH3228 GIS in Hydrology, MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling

Postrequisites: no

As a result of studying the discipline, the student is able to:

- understand the general mathematical methods used to solve practical problems of groundwater flow;
- assess the transport of pollutants in groundwater;
- solve problems related to surface and underground hydrology with concrete examples;
- use well-known mathematical models in groundwater, based on solving the equation of groundwater flow,
- apply numerical methods for solving the flux and mass transfer equations in groundwater,
- to analyze the sources of pollution of soil and groundwater;

Studying topics:

1. Introduction to groundwater modelling
2. Groundwater flow basic equations.
3. The finite difference method to solve the groundwater flow equation
4. Introduction to MODFLOW
5. Groundwater Flow models case studies I
6. Groundwater Flow models case studies II
7. Calibration of aquifers and Inverse modelling.
8. Sources of pollution in groundwater
9. Basic equation of mass transport in porous media

10. Approaches to model physical interactions and chemical reactions in groundwater

11. Numerical methods to solve the mass transport equation: Finite differences and Finite elements

12. Numerical methods to solve the mass transport equation: the method of characteristics

13. The random walk method.

14. Introduction to heterogeneity modelling of hydrodynamic parameters

15. Characterization of uncertainty of mass transport problems. An advance real case study

HP2233 Hydrological processes – 3 credits

Prerequisites: FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, HPh2212 Hydrophysics, HC2213 Hydrochemistry.

Postrequisites: HC3207 Hydrological calculation, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS

As a result of studying the discipline, the student will be able to:

- To outline the key processes of the hydrological cycle: precipitation, evapotranspiration, soil and ground water, infiltration, snow hydrology and runoff;
- To understand reasons for variability and distribution of surface water and groundwater resources, and to assess water balance;
- To understand key aspects of hydrometry, water quality of rivers and lakes.

Studying topics:

1. Introduction to hydrological processes
2. Equation water balance of catchment
3. Soil properties and storage capacity
4. Infiltration and evaporation
5. Runoff-rainfall processes
6. Lake and river hydrology
7. Water quality and suspended solids transportation in surface waters
8. Hydrological monitoring
9. Snow and winter hydrology

Module of professional practice – 18 credits

As a result of studying the module, a student is able to:

- know the general laws of the development of nature and society, to own a culture of thinking; to be guided in ideals and values of a democratic society;
- have an idea of the role of hydrology in related geosciences, the application of hydrometeorological information in various fields of economic activity of the state.
- be able to produce the main types of hydrometeorological observations and work, carry out the processing of observation materials and prepare them for

publication, own modern methods of collecting, processing and analyzing hydrometeorological information;

- distinguish the basic laws of rest and movement of water in canals, rivers, pipelines, energy interpretation of the processes occurring in open channels and own methods of hydraulic calculations for rivers, canals, hydrotechnical and hydrometric facilities.

TP Training practice – 10 credits

The purpose is to consolidate the theoretical knowledge and deepening practical skills for conducting hydrological researches, processing hydrometric measurement data and organizing observations of the characteristics of the water regime of rivers and lakes.

As a result of training practice, the student will be able to:

- use practical and consolidate the theoretical knowledge gained during the course of hydrometry;
- organize field hydrometric work;
- apply the methods of field hydrometric measurements and their post-processing;
- gain skills to work with hydrometric instruments in the field;
- independently perform small-scale hydrometric studies, assess the accuracy of the results obtained;
- learn safety in the field (when going to water bodies).

Field works is carried out on a small river (2 weeks), on a large river (2 week) and on a lake-reservoir (1 week).

Content of practice works:

1) The works on the small river
2) The works on the big river
3) The works on the lake-reservoir

IP Industry practice in the specialty – 5 credits

The purpose is to the theoretical knowledge and deepening practical skills for conducting hydrological researches, processing hydrometeorological characteristics, acquiring skills for independent work, familiarity with industry activities by organizing a hydrometeorological profile.

As a result of industry practice, the student will be able to:

- to know the hydrographic characteristics of the rivers and their basins;
- be able to summarize the data on the hydrometeorological conditions of formation of the regime of water bodies (calculation of evaporation from the water surface and from land, precipitation, study of temperature and deficit of air humidity, etc.);
- know the power sources of the river;
- build typical hydrographs and calculate their components by type of food;

- determine the characteristics and mode of solid flow, the chemical composition of water, thermal and winter regime of rivers.
- measure water flow and suspended sediment;
- build water discharge curves and perform flow calculation.
- determine the physiographic conditions for the formation of river flow;
- determine the hydrological knowledge and analyze the source data.
- understand the characteristics of the level mode.
- determine the flow regime of water and sediment and the calculation of their main characteristics;
- determine the norm and variability of the annual flow, the intra-annual distribution of the flow, the change in these characteristics along the length of the river or area;
- understand the analysis and calculation of hydrographs, the volume and maximum expenditure of spring flood or rain floods, the method of calculation;
- calculate the characteristics of river flow, solid flow, and chemical composition of the river;
- analyze the chemical composition and water pollution;
- calculate hydroecological indicators.

Content of practice works:

1) Hydrological Studies
2) Hydrometric studies
3) Hydrological calculations
4) Hydrological forecasts

UGP Undergraduate practice (work on the preparation of the diploma) – 3 credits

The purpose of undergraduate practice is the formation and development of professional knowledge in the specialty of hydrology, the collection of hydro-meteorological materials/data necessary for carrying out the diploma work, the study of known methods for assessing the elements of the water regime of water bodies, the ecological status and characteristics of water bodies, water management measures in the studying river basin.

As a result of industry practice, the student will be able to:

- use the main provisions of the methodology and apply them when working on the chosen topic of the thesis;
- use modern methods of collecting, analyzing and processing scientific information;
- to study literary sources on the subject being developed with the aim of their use in the performance of the thesis;
- apply the methods of research and experimental work;
- know the rules of operation of research equipment;
- apply the methods of analysis and processing of experimental data;
- analyze information technologies in scientific research, software products related to the field of hydrology;

- know the requirements for the design of scientific and technical documentation;

- to analyze, systematize and summarize scientific and technical information on the topic of the thesis;

- perform theoretical or experimental research within the framework of the tasks;

- analyze the results;

- compare the results of the study of the object of development with the head;

- perform an analysis of the scientific and practical significance of the research.

- to analyze using modern methods;

- substantiate the relevance of the theoretical and practical significance of the problem under study;

- analyze the scientific literature;

- work with catalogs of scientific literature and databases;

- prepare scientific literature reviews on the problem under study;

- draw up a research program;

- choose the correct form for presenting the research results;

- prepare presentations of research results;

- interpret the results of research in professional activities.

Content of practice works:

Undergraduate practice is carried out in the form of a real diploma project carried out by a student within the framework of the approved topic of the diploma works, taking into account the interests and capabilities of the units in which it is conducted.

The work of a student during the period of practice is organized in accordance with the plan for the implementation of the thesis: the choice of topic, the definition of the problem, the object and subject of research; formulation of the purpose and objectives of the study; theoretical analysis of literature and research on the problem, selection of the necessary sources on the topic; selection of the object of study; definition of a complex of research methods.

CATALOG OF ELECTIVE DISCIPLINES

GENERAL EDUCATION DISCIPLINES (GE)			
COMPULSORY COMPONENT (CC)			
Social and humanitarian module - 6 credits			
Code MHK1101	**Modern history of Kazakhstan**		
Prerequisites	no	Prerequisites	no
Credits	3	Semester	1
Aim of discipline	To form a system of scientific views on the history of modern Kazakhstan society in the context of the world historical process.		
Abstract of discipline	Large-scale transformations are accompanied by the modernization of public consciousness, which involves the transformation of learning based on a problem-based approach. Knowledge gained from the study of modern history of Kazakhstan contributes to the understanding of the dynamics of the development of historical processes and forms value reference points for ethnic, social, cultural identity in the surrounding world. The successful implementation of the state programs "Madeni Mura" and "Halyk Tarih Tolқynynda" broadened the horizons of historical knowledge and led to fundamental work aimed at changing the public consciousness and forming a unified Nation of strong and responsible people. The present stage of development of our country is characterized by the Third Modernization of Kazakhstan, the creation of a new model of economic growth that will ensure the global competitiveness of the country. Modernization of the economy is inextricably linked with the modernization of consciousness, when every citizen of Kazakhstan will understand the need for change in order to move to a qualitatively new level of development of his country. Kazakhstan society should have a spiritual and ideological core for the successful implementation of the goals set, this is facilitated by the program "Ruhani zhangyru" which reveals the mechanisms for modernization of public consciousness and is based on the continuity of spiritual and cultural traditions. Knowledge of the history of their people contributes to a broader perception and ability to rethink.		
Code Phil2102	**Philosophy**		
Prerequisites	MHK1101 Modern history of Kazakhstan.	Postrequisites	no
Credits	3	Semester	4
Aim of discipline	Formation of students' holistic system understanding of philosophy as a special form of knowledge of the world, its main sections, problems and methods of their study in the context of future professional activity.		
Abstract of discipline	Discipline "Philosophy" is aimed at developing students' openness of consciousness, understanding their own national code and		

	national identity, spiritual modernization, competitiveness, realism and pragmatism, independent critical thinking, the cult of knowledge and education, and the mastery of such key ideological concepts as justice, dignity and freedom, as well as the development and strengthening of the values of tolerance, intercultural dialogue and the culture of peace. Particular attention is paid to the problems of preserving national identity, the inner core of the national "I" and the national spirit, which are reflected in the project "Ruhani zhangyru", the role of philosophy in modernizing public consciousness and solving global modern problems. Philosophy contributes to the formation of students' philosophical reflection, skills of self-analysis and moral self-regulation, contributes to the development of research abilities and the formation of intellectual and creative potential.		
Instrumental Module – 15 credits			
Code FL1103	**Foreign language**		
Prerequisites	no	Postrequisites	POFL2202 Professionally-oriented Foreign Language
Credits	6	Semester	1, 2
Aim of discipline	To form student's knowledge for active use of a foreign language both in everyday and professional communication.		
Abstract of discipline	The "Foreign Language" discipline is aimed at further developing the language competencies acquired at school as a part of English language discipline program (General English), as well as deepening skills in the use of English as a means of communication with the formation of the following competencies: communicative (reading, writing, listening, speaking), language (pronunciation, vocabulary, grammar), general cultural and interpersonal.		
Code K(R)L1104	**Kazakh (Russian) language**		
Prerequisites	no	Postrequisites	PK(R)L2201 Professional Kazakh (Russian) language
Credits	6	Semester	1, 2
Aim of discipline	Provide high-quality Kazakh (Russian) language proficiency in the context of Kazakh national culture as an instrument of social, intercultural, professional and personal communication through the formation of communicative competence in all types of speech activiies in accordance with the levels of proficiency in a foreign language according to the Council of Europe scale (A1, A2 + LSP; B1, B2 + LSP; C1 + LSP).		
Abstract of discipline	The discipline "Kazakh (Russian) language" is aimed at shaping the social and humanitarian outlook of students in the context of a nationwide idea of spiritual modernization, involving the development of internationalism, tolerant attitude to world cultures		

	and languages as the basis of national consciousness and cultural code. modern technologies, the use and transfer of which are able to ensure the modernization of the country and the personal career growth of future specialists.		
Code ICT1105	**Information and communication technology**		
Prerequisites	no	Postrequisites	MMSPHI3224 Modern methods of statistical processing of hydrological information, GISH3228 GIS in Hydrology, MHPGIS4227 Modeling of hydrological processes in GIS
Credits	3	Semester	2
Aim of discipline	Formation of the ability to critically evaluate and analyze processes, methods of searching, storing and processing information, methods of collecting and transmitting information through digital technologies.		
Abstract of discipline	The discipline "Information and communication technologies" is designed to build the ability to critically understand the role and importance of modern information and communication technologies in the era of digital globalization. In connection with the entry of the economy of Kazakhstan into the era of the Fourth Industrial Revolution, the adoption of a comprehensive program “Digital Kazakhstan”, the development of new technologies such as the Internet of things, cloud technologies, big data, blockchain, etc. thinking, the acquisition of knowledge and skills in the use of modern information and communication technologies in various activities.		
ELECTIVE COMPONENT (EC)			
Module of Social-Political Knowledge – 4 credits			
Code Soc2106	**Sociology**		
Prerequisites	MHK1101 Modern history of Kazakhstan	Postrequisites	Psy2107 Psychology
Credits	3	Semester	3
Aim of discipline	Formation of sociological thinking and imagination of the dynamic social world in which we live, as well as in the formation of critical thinking and analysis of modern societies, their social structures, systems and institutions.		
Abstract of discipline	The discipline "Sociology" will allow students to get deeper into the basics of sociology, including topics and applied aspects of research, theory and methodology. By developing what S. Wright Mills calls “sociological imagination,” the discipline will provide insights into how culture, religion, history, people and institutions		

	intersect in shaping their own experience, life chances and identity. Throughout the course, a number of macro- and micro-sociological "perspectives" will be presented and issues related to social inequality and accessibility of education, ethnicity, gender, social class, as well as institutions such as family, education, and the media, which play an important role in shaping our own life and the whole social world where we live. Based on the programmatic paper "Looking into the Future: Modernizing Public Consciousness" by the President of the country, the course considers the features of the process of modernizing consciousness and adapting Kazakh society to the global challenges of our time.		
Code Pol2107	**Political Science**		
Prerequisites	no	Postrequisites	no
Credits	2	Semester	4
Aim of discipline	The study of the laws governing the formation and functioning of politics, the preparation of students for participation in the political life of the country, the formation of an active citizenship.		
Abstract of discipline	The discipline "Political Science" is aimed at forming the knowledge of the laws and patterns of world politics and modern political processes, explaining the essence and content of the policies of national states, based on national security and the realization of national interests. The study of this discipline contributes to the formation of the socio-humanitarian outlook as the basis for the modernization of public consciousness. Understanding of internal and external connections and relationships, major trends and patterns operating in different political systems, objective criteria of the social policy dimension contributes to the formation of national and civic identity.		
Cultural heritage and interpersonal communication module - 4 credits			
Code Cul2106	**Culturology**		
Prerequisites	MHK1101 Modern history of Kazakhstan	Postrequisites	no
Credits	3	Semester	3
Aim of discipline	Formation to students' understanding of the specifics of the development of national culture in the context of world culture and civilization, the need for preservation of the cultural code of the Kazakh people, and the ability to pursue the cultural heritage of the Kazakh people in a dynamically changing multicultural world and society in independent professional activity.		
Abstract of discipline	The discipline "Culturology" is aimed at developing the socio-humanitarian worldview as the basis for the modernization of public consciousness through the formation of cultural identity, the ability to analyze and evaluate cultural situations based on an		

	understanding of the nature of cultural processes, the specifics of cultural objects, the role of cultural values in intercultural communication.		
Code Psy2107	**Psychology**		
Prerequisites	Soc2106 Sociology	Postrequisites	no
Credits	2	Semester	4
Aim of discipline	Formation to students' social-personal and instrumental competences in the field of psychological theory and practice of interpersonal communication, necessary in professional activities.		
Abstract of discipline	The discipline "Psychology" contributes to the formation of a general psychological culture of a person, awareness of his past, present and future from psychological positions, as well as for mastering knowledge of the socio-psychological patterns of behavior in interpersonal communication.		
Ecological Module - 4 credits			
Code ESD2108	**Ecology and sustainable development**		
Prerequisites	no	Postrequisites	HCh2213 Hydrochemistry, IRBME4229 Integrated River basin management and Ecohydrology, PPMTRK4230 Problem of pollutions of the main transboundary rivers of Kazakhstan
Credits	2	Semesters	4
Aim of discipline	Formation of sociological thinking and imagination of the dynamic social world in which we live, as well as in the formation of critical thinking and analysis of modern societies, their social structures, systems and institutions.		
Abstract of discipline	Basic laws of interaction of living organisms with the environment; mechanisms for the sustainability and functioning of ecosystems and the biosphere; the place and role of ecology in solving modern economic and political problems; global environmental problems of our time, causes, stages of their formation and consequences; sustainable development of nature and society, international cooperation in the field of environmental protection.		
Code HLS2109	**Human Life Safety**		
Prerequisites	no	Postrequisites	no
Credits	2	Semester	3
Aim of discipline	Formation of students' holistic system understanding of life safety opportunities. The discipline "Life Safety of a Person" aims to formulate students' theoretical and practical skills to protect against		

	dangerous and harmful environmental factors in all spheres of human activity.		
Abstract of discipline	Classification of emergencies, hazards. Classification of hazardous and harmful factors. Legislative and legal acts in the field of life safety. Tasks, principles of construction and functioning of Civil Protection in the Republic of Kazakhstan. Natural hazards. Ensuring biomedical safety. Social dangers. Protection against weapons of mass destruction. Sustainability of the functioning of economic objects in emergencies. Human exposure to noise, vibration, ultrasound, infrasound, EMF, and others. Radiation. Ionizing radiation. Radiation hazardous objects. Ensuring chemical safety. Fire, explosions in industry, in everyday life, in the natural environment; the reasons for their occurrence, the consequences. Basics of organizing and conducting rescue operations.		
BASIC DISCIPLINES (BD) - 70 credits			
OBLIGATORY COMPONENT (OC) – 25 CREDITS			
Professional language Module - 4 credits			
Code PK(R)L2201	**Professional Kazakh (Russian) language**		
Prerequisites	K(R)L1104 Kazakh (Russian) Language	Postrequisites	no
Credits	2	Semester	3
Aim of discipline	Formation to students' skills and techniques of effective speech interaction in various situations of communication, the formation of grammatical skills and knowledge. Implementation of the main tasks of speech models and relative types at various levels of learning the state language.		
Abstract of discipline	The discipline "Professional Kazakh (Russian) language" is aimed at the further development of knowledge of Kazakh (Russian) language, based on pre-university knowledge and skills. The course goals and objectives are taken as a basis of the course at each level. The knowledge gained is aimed at the performance of all types of speech actions (listening, reading, speaking and writing), the formation of correct speech and literate writing, the definition of the requirements set for students.		
Code POFL2202	**Professionally-oriented foreign language**		
Prerequisites	FL1103 Foreign Language	Postrequisites	no
Credits	2	Semester	4
Aim of discipline	Formation of a professionally oriented communicative competence of students, allowing them to integrate into the international		

	professional environment and use a professional oriental language as a means of intercultural and professional communication.		
Abstract of discipline	The discipline "Professionally-oriented foreign language" is aimed at contributing to the formation of functional features of oral and written vocational-oriented texts, documentation requirements (within the program), adopted in professional communication and in the country of the studied language, strategies of communicative behavior in situations of international professional communication.		
Module Hydrometeorological – 9 credits			
Code GM1203	**General meteorology**		
Prerequisites	no	Postrequisites	PESGK1210 Physical, economic and social geography of Kazakhstan, HR1205 Hydrology of rivers, HPh2212 Hydrophysics, WBS2214 Water balance studies, HC3207 Hydrological calculations, EWRM3219 Economics of water resources management, GRH3223 General and river hydraulics, WRNH3231 Water-related natural hazard, IMP4232 Introduction to mudflow processes
Credits	3	Semester	1
Aim of discipline	Formation of students' solid knowledge about atmospheric composition and its general properties and deep understanding of the nature of basic physical processes taking place in atmosphere in their close interaction with the earth's surface and near-earth space.		
Abstract of discipline	The discipline "General meteorology" is aimed at forming fundamental knowledge among students about the basic physical processes occurring in atmosphere based on their qualitative and quantitative description. The following aspects will be considered during discipline studying: subject and tasks of meteorology; the atmospheric air composition, vertical structure of atmosphere; basis of atmospheric static; transformation processes of solar radiation in atmosphere; radiation balance of underlying surface, atmosphere and system of earth's surface – atmosphere; thermal regime of soil and water bodies; exchange of heat, moisture and momentum between atmosphere and earth's surface; air currents in atmosphere.		
Code FH1204	**Fundamentals of hydrology**		
Prerequisites	no	Postrequisites	PESGK 1210 Physical, economic and social

			geography of Kazakhstan, RBW1221 River basins of the world, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, WBS2214 Water balance studies, HP2233 Hydrological processes, HFS3215 Hydrological field survey, HC3207 Hydrological calculation, HSER2233 Hydrology of the seas and estuaries of rivers, HF3216 Hydrological forecasts, HM4227 Hydrological modeling, MMGFT4232 Mathematical modeling of the groundwater flow and transport.
Credits	3	Semester	1
Aim of discipline	Formation of knowledge about the composition and properties of the hydrosphere, its individual components (excluding groundwater), the planet's water resources and its individual parts, the use of water resources by humans, as well as give an idea of the hydrology of rivers.		
Abstract of discipline	Discipline contributes to the formation of an integrated assessment of the processes and patterns occurring in the hydrosphere objects and studies the chemical and physical properties of natural waters, the physical bases of the processes in the hydrosphere, the water cycle in nature and the Earth's water resources, the hydrology of seas, lakes, rivers, glaciers, groundwater and wetlands.		
Code HR1205	**Hydrology of rivers**		
Prerequisites	HM1208 Higher Mathematics, Phys1209 Physics, GM1203 General meteorology, FH1204 Fundamental hydrology	Postrequisites	Hyd2206 Hydrometry, WBS2214 Water-balance studies, HFS3215 Hydrological field survey, HP2233 Hydrological processes, WRNH3231 Water-related natural hazard, HC3207 Hydrological calculation, EWRM3219 Economics of water resources management, HF3216 Hydrological forecasts, HM4227 Hydrological modeling

Credits	3	Semester	2
Aim of discipline	Formation to hydrology students the basis of scientific knowledge in the field of hydrology river, regularities of river formation, water flow, hydrological and water regime of watercourses, characteristics and conditions of the winter regime and solid runoff.		
Abstract of discipline	Discipline is aimed at the formation of knowledge, revealing the concepts: physiographic, geological and morphometric characteristics of the river basin, river network, river fed, water loss for evaporation and infiltration, water balance of the river basin and river section, water regime of rivers, thermal and ice regime of rivers , river sediments, channel processes.		
Module Means and methods of measurement and calculation of flow characteristics - 12 credits			
Code Hyd2206	**Hydrometry**		
Prerequisites	HM1208 Higher Mathematics, Phys1209 Physics, FH1204 Fundamentals of hydrology, GC1218 Geodesy and cartography, HR1205 Hydrology of river	Postrequisites	WBS2214 Water balance studies, HFS3215 Hydrological field survey, MMSPHI3224 Modern methods of statistical processing of hydrological information, HC3207 Hydrological calculation, EWRM3219 Economics of water resources management, AUHC3217 Assessment of uncertainty in hydrological calculation, HF3216 Hydrological forecasts
Credits	6	Semester	3, 4
Aim of discipline	Formation of knowledge about the principles and methods of monitoring water bodies and contains basic information about the network of hydrological observations, methods for determining and studying hydrological elements, hydrometric instruments, as well as how to process the results of observations, prepare annual publications of the State Water Cadastre and create information base for hydrological justification of water management and hydrotechnical projects.		
Abstract of discipline	Discipline is aimed at the formation of practical bases for stationary and expeditionary hydrometric studies of water bodies, their office processing. Principles of organization and tasks of hydrometric surveys for scientific and practical purposes, requirements for the river section and equipment of hydrological posts under various conditions, measurement of water levels, survey works, measurements of water velocity, monitoring water temperature,		

	solid runoff, ice phenomena, accuracy carried out are considered. measurements and their metrological conformity, the composition of standard and special hydrometric observations.		
Code HC3207	**Hydrological calculations**		
Prerequisites	HM1208 Mathematics, Phys1209 Physics, GM1203 General meteorology, FH1204 Fundamental hydrology, HR2207 Hydrology of rivers, Hyd2206 Hydrometry, HP2233 Hydrological processes	Postrequisites	MMSPHI3224 Modern methods of statistical processing of hydrological information, AUHC3217 Assessment of uncertainty in hydrological calculation, AAIWR4220 Assessment of anthropogenic impacts on water runoff, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS
Credits	6	Semester	5, 6
Aim of discipline	Formation of students' ability to independently carry out calculations and improve existing or develop new methods for determining the calculated hydrological characteristics necessary to provide the needs of construction design, the creation of objects water consumptions and water use.		
Abstract of discipline	Discipline forms a complex of knowledge, allowing students to acquire practical knowledge and methods for calculating river runoff characteristics depending on runoff-forming factors, methods and schemes for calculating water discharges of various types, features for calculating annual, intra-annual, maximum and minimum river runoff with hydrometeorological information and with its lack or absence. The issues of assessing the characteristics of solid runoff and the level regime of rivers are included.		
ELECTIVE COMPONENT			
STEM-module – 6 credits			
Code HM1208	**Higher Mathematics**		
Prerequisites	no	Postrequisites	GM1203 General meteorology, FH1204 Fundamentals of hydrology, HR1205 Hydrology of river, GC1211 Geodesy and Cartography, Hyd2206 Hydrometry, HC3207

			Hydrological calculations, HF3216 Hydrological forecasts, HPh2212 Hydrophysics, HFS3215 Hydrological field survey, AUHC3217 Assessment of uncertainty in hydrological calculation, HELR2218 Hydraulic engineering and land reclamation, MMGFT4232 Mathematical modeling of the groundwater flow and transport
Credits	3	Semesters	1
Aim of discipline	The main purpose of the course is to formation of students' theoretical knowledge, practical skills in mathematics, helping to simulate, analyze and solve various hydrology problems.		
Abstract of discipline	The discipline «Higher Mathematics» introduces students to the possibility of using the basic concepts and methods of linear algebra, analytic geometry, the differential calculus function of one and several independent variables, the integral calculus function of one and several independent variables in describing hydrological processes.		
Code Phys1209	**Physics**		
Prerequisites	no	Postrequisites	GM1203 General meteorology, FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, HPh2212 Hydrophysics, GRH3223 General and river hydraulics, HC3207 Hydrological calculation
Credits	3	Semesters	1
Aim of discipline	Formation of students' ideas about the modern physical map of the world and scientific worldview.		
Abstract of discipline	The discipline «Physics» is fundamental for the description and understanding of hydrological processes. It reveals the essence of the basic concepts, laws, theories of classical and modern physics, their inner interconnection and integrity for mastering the hierarchy of physical laws and concepts, the limits of their applicability, which will effectively use the knowledge gained in specific situations.		
Module Physical-geographic aspects in hydrology - 4 credits			

Code PESGK 1210	**Physical, economical and social geography of Kazakhstan**		
Prerequisites	GM1203 General meteorology, FH1204 Fundamentals of hydrology	Postrequisites	HLR2222 Hydrology of lakes and reservoirs
Credits	2	Semester	2
Aim of discipline	Formation of students' basic knowledge about the formation and development of the economy of Kazakhstan, its dependence on the natural resource potential, social-demographic structure, regional patterns of spatial differentiation, economic use and the ecological state of the environment of the Republic of Kazakhstan.		
Abstract of discipline	The discipline "Physical, economic and social geography of Kazakhstan" is aimed at developing the ability of future specialists to distinguish the sectoral composition; observe the economic and geographical processes and phenomena; to characterize the population and the economy; highlight cause-effect relationships; draw up diagrams of production and interindustry cycles and links; identify the principles of economic and geographic zoning; to make a comparative description of the economy of individual territories; to find connections in the nature-economy system; analyze the geological history of the development of the territory of the Republic of Kazakhstan, the main types of relief, hydrometeorological conditions, etc .; to study the problems of the influence of anthropogenic factors on the natural complexes of Kazakhstan; analyze the relationship of the components of geosystems and use the knowledge gained in solving applied problems.		
Code GC1211	**Geodesy and Cartography**		
Prerequisites	HM1209 Higher Mathematics, FH2206 Basics of Hydrology	Postrequisites	Hyd2206 Hydrometry, HELR2218 Hydraulic engineering and land reclamation, GARBM2233 Geomorphological approach to river basin management, HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management
Credits	2	Semester	2
Aim of discipline	Formation of student's knowledge about the procedure for conducting topographic and geodetic works on creating topographic maps and plans: determining the location of object on		

	a plane and in space, including the task of determining areas, orientation directions for the movement of objects for creating geodetic foundation for building engineering structures in the form of a theodolite course or system of moves: determine the heights and elevations.		
Abstract of discipline	Discipline is aimed at the formation of knowledge about the coordinate system, topographic maps and plans. Geodetic networks and topographic surveys, linear-angle measurements, elevation measurements are considered.		
Module Physical-chemical aspects in hydrology - 6 credits			
Code HPh2212	**Hydrophysics**		
Prerequisites	HM1208 Higher mathematics, Phys1209 Physics, GM1203 General meteorology	Postrequisites	HLR2222 Hydrology of lakes and reservoir, HP2233 Hydrological processes, HSER2233 Hydrology of the seas and estuaries of rivers, HPCS3228 Hydrodynamic processes of the Caspian Sea
Credits	3	Semester	3
Aim of discipline	To form students' knowledge in the field of physical properties of natural waters and physical processes occurring in water bodies of the surface land. A hydrologist is able to understand the physical nature of hydrological phenomena and processes, be able to apply fundamental physical laws and mathematical methods in analyzing natural processes in water objects and their interaction with the environment, correctly select research methods and methods for calculating hydrophysical characteristics, and to assess their validity and reliability.		
Abstract of discipline	Discipline is aimed at forming the ability to assess the characteristics of the hydrosphere as a geophysical system, the structure of water as a physical body. The physical properties of water, ice and snow and their role in hydrological phenomena, water-physical properties of soils, heat exchange processes, ice-thermal processes, waves in water bodies, the role of modern hydrophysical studies in the rational use and protection of water resources are studied.		
Code HCh2213	**Hydrochemistry**		
Prerequisites	ESD2108 Ecology and sustainable development	Postrequisites	AAIWR4220 Assessment of anthropogenic impacts on water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment, PPMTRK4230 Problem of pollutions of the

			main transboundary rivers of Kazakhstan
Credits	2	Semester	3
Aim of discipline	Formation of ideas about the basic laws of chemistry, the nature of the chemical bond, the chemical composition of natural waters, the factors responsible for the formation of their chemical composition, and the regularities in the course of various chemical processes in the hydrosphere.		
Abstract of discipline	Discipline is directed to consideration and study questions in the chemistry of surface and groundwater, the theoretical foundations of water chemistry, and applied issues of regional water chemistry.		
Module Applied Aspects in Hydrology - 6 credits			
Code WBS2214	**Water-balance studies**		
Prerequisites	GM1203 General meteorology, FH1204 Fundamentals of hydrology, HR1205 Hydrology of river, Hyd2206 Hydrometry, HLR2222 Hydrography of lakes and reservoirs	Postrequisites	EWRM3219 Economics of water resources management, IRBME4229 Integrated River basin management and Ecohydrology, RSGEC3231 River system and global environmental change, ECCWM4232 Effects of climate change on watershed management, MMGFT4232 Mathematical modeling of the groundwater flow and transport
Credits	3	Semester	4
Aim of discipline	Formation to students the ability to apply various methods of organizing and conducting comprehensive studies studying the water balance of river catchments, water bodies, glaciers and other natural objects, about the basic patterns of formation of the main elements of water balance: precipitation, runoff, total evaporation, etc.		
Abstract of discipline	Discipline is aimed at the formation of knowledge for the organization of water-balance studies, based on the equation of water balance. Questions are considered: research and calculation of the main elements of the water balance, water balance and surface water resources. Water balance and water resources of the regions.		
Code HFS3215	**Hydrological field survey**		
Prerequisites	HM1208 Higher Mathematics, FH1204 Fundamentals of	Postrequisites	EWRM3219 Economics of water resources management, AAIWR4220 Assessment of anthropogenic impacts on

	hydrology, HR1205 Hydrology of rivers, GC1211 Geodesy and cartography, Hyd2206 Hydrometry, HELR2218 Hydraulic engineering and land reclamation		water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment, HSER2233 Introduction to GARBM4230 Geomorphological approach to river basin management
Credits	3	Semester	5
Aim of discipline	Formation of ideas about modern survey methods in studies of water bodies (rivers, lakes, reservoirs, wetlands, glaciers, snow cover, some hydrological phenomena) affecting economic objects.		
Abstract of discipline	Discipline forms of research works skills and provides for a consistent familiarization with the main regulatory documents, organizing and providing surveys, the composition of the necessary preparatory work, the content and methods of conducting full-scale (stationary and expeditionary) hydrological research, as well as using such modern techniques and methods as aerospace information.		
Module Calculating and practical aspects in hydrology – 9 credits			
Code HF3216	**Hydrological forecasts**		
Prerequisites	HM1208 Higher mathematics, FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, HP2233 Hydrological processes, HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological	Postrequisites	MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling, HSWC4229 Hydrological services for the water consumers

	information, AUHC3217 Assessment of uncertainty in hydrological calculation		
Credits	6	Semester	6, 7
Aim of discipline	Forms the abilities to analyze patterns of occurrence and development of hydrological phenomena and methods for predicting hydrological processes and phenomena.		
Abstract of discipline	Discipline is aimed at generating knowledge of hydrological forecasts. Short-term and long-term forecasts, forecasts of water runoff and river levels based on regularities of river runoff movement, forecasts of flat river flow, mountain river runoff forecasts, rain flood forecasts, forecasts of ice phenomena in rivers and reservoirs are considered		
Code AUHC3217	**Assessment of uncertainty in hydrological calculation**		
Prerequisites	HM1208 Higher mathematics, Hyd2206 Hydrometry, HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological information	Postrequisites	HF3216 Hydrological forecasts, HSWC4229 Hydrological services for the water consumers, AAIWR4220 Assessment of anthropogenic impacts on water runoff
Credits	3	Semester	6
Aim of discipline	Forms the ability of students to assess hydrometeorological conditions and choose methodological approaches to assessing the accuracy of hydrological characteristics and runoff parameters.		
Abstract of discipline	Discipline forms the possibility of determining the features and type of error of hydrological observations and calculations. Assessment of the effectiveness of the norm of the coefficient of variation to a multiyear period, the assessment of the accuracy of runoff parameters taking into account information, the assessment of random and systematic errors, group analysis of hydrological data are considered.		
Module Solution of water management issues – 9 credits			

Code HELR2218	**Hydraulic engineering and land reclamation**		
Prerequisites	HM1208 Higher mathematics, GC 1211 Geodesy and Cartography	Postrequisites	HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management, AAIWR4220 Assessment of anthropogenic impacts on water runoff, WRNH3231 Water-related natural hazard
Credits	3	Semester	4
Aim of discipline	Forms the ability to assess the main types of river hydraulic structures (hydraulic structures) for various purposes and structures and hydraulic systems that are used in the water industry, the study of the principles of using water resources with the help of hydraulic structures for nature conservation.		
Abstract of discipline	Discipline is aimed at studying the main types of river hydraulic structures for various purposes and structures and waterworks, which are used in water management, and the formation of knowledge of the principles of using water resources with the help of hydraulic structures for nature conservation.		
Code EWRM3219	**Economics of water resources management**		
Prerequisites	GM1203 General meteorology, HM1208 Mathematics, GC1211 Geodesy and cartography, HR1205 Hydrology of rivers, Hyd2206 Hydrometry, WBS2214 Water balance studies, HELR2218 Hydraulic engineering and land reclamation, HFS3215 Hydrological field survey	Postrequisites	AAIWR4220 Assessment of anthropogenic impacts on water runoff, HSWC4229 Hydrological services for the water consumers, IRBME4229 Integrated River basin management and Ecohydrology, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment
Credits	3	Semester	5

Aim of discipline	Formation of the ability to understand the tasks, functions and composition of water economy and to teach students to perform water economy calculations, the results of which contribute to the integrated and rational use of water resources.		
Abstract of discipline	Discipline forms the basis of engineering training of hydrologists in the field of economic use and protection of water resources. Hydrology as a science meets the practical needs of water engineering design, hydraulic engineering and engineering solutions for water protection measures.		
Code AAIWR4220	**Assessment of anthropogenic impacts on water runoff**		
Prerequisites	HCh2213 Hydrochemistry, HC3207 Hydrological calculations, HELR2218 Hydraulic engineering and land reclamation, HFS3215 Hydrological field survey, AUHC3217 Assessment of uncertainty in hydrological calculation, EWRM 3219 Economics of water resources management, UH3231 Urban hydrology, PPMTRK2233 Problem of pollutions of the main transboundary rivers of Kazakhstan	Postrequisites	no
Credits	3	Semester	7
Aim of discipline	The ability to assess significant changes in runoff characteristics due to anthropogenic impacts, the ability to apply known methods of quantifying the impact of economic activity on river runoff, and		

	the ability to assess various factors of economic activity on the hydrological characteristics of runoff and changes in the water regime of rivers and water resources of river basins in connection with human activities for the rational and safe use of them in the future.		
Abstract of discipline	Discipline is aimed at developing an understanding of quantitative assessment methods of the impact of economic activity on river runoff, changes in river runoff in connection with economic activities (using the example of mountain and lowland watersheds), changes in the total runoff of some rivers and the Earth's water resources under the influence of anthropogenic factors.		
Module Global hydrology and hydrology of reservoirs – 6 credits			
Code RBW1221	**River basins of the world**		
Prerequisites	FH1204 Fundamentals of hydrology, PESGK 1210 Physical, economic and social geography of Kazakhstan	Postrequisites	HSER2233 Hydrology of the seas and estuaries of rivers, RSGEC3231 River system and global environmental change
Credits	3	Semester	2
Aim of discipline	Formation of the ability to assess the conditions of the formation of river runoff, to know the water regime, hydrographic characteristics and the main hydrological parameters of large water bodies of the continents of the Earth and Kazakhstan.		
Abstract of discipline	Discipline is focused on the study of physiographic features of the regions of the World and Kazakhstan, hydrographic and general features of the regime of rivers, lakes and reservoirs, and generates knowledge in the field of formation of the hydrometeorological regime of water bodies, depending on runoff-forming factors.		
Code HLR2222	**Hydrology of lakes and reservoir**		
Prerequisites	PESGK 1210 Physical, economic and social geography of Kazakhstan	Postrequisites	WBS2214 Water-balance studies, HPCS3228 Hydrodynamic processes of the Caspian Sea, IRBME4229 Integrated River basin management and Ecohydrology
Credits	3	Semester	3
Aim of discipline	Formation practical skills for studying the peculiarities of the hydrological regime of lakes and reservoirs as land water bodies, introduces the organization, methodology and main directions of hydrological studies of lak bodies of water.		

Abstract of discipline	Discipline is aimed at the formation of knowledge and skills of integrated research and solving problems related to the use and environmental problems of lake-like reservoirs, the production of hydrological work on lakes and reservoirs, processing and analysis of existing hydrological information about it.		
PROFILE DISCIPLINES – 33 credits			
OBLIGATORY COMPONENT – 6 credits			
Module Statistical-mathematical and hydraulic calculations - 6 credits			
Code GRH3223	**General and river hydraulics**		
Prerequisites	GM1203 General meteorology, HM1208 Mathematics, Ph1210 Physics	Postrequisites	DChF3225 Dynamics of channel flow, ChP3226 Channel processes
Credits	3	Semester	5
Aim of discipline	Forms the ability to apply hydraulic methods necessary to solve specific practical problems associated with various cases of fluid movement.		
Abstract of discipline	Discipline is aimed at developing knowledge of open flow hydraulics and studies the following issues: balance of incompressible fluid (hydrostatics), hydraulic schematization of fluid flow, hydraulic resistance, water movement in open channels, hydraulic jump, weirs, water movement in river channels, unsteady water movement.		
Code MMSPHI3224	**Modern methods of statistical processing of hydrological information**		
Prerequisites	ICT1105 Information and Communication Technologies, Hyd2206 Hydrometry, HC3207 Hydrological calculation	Postrequisites	AUHC3217 Assessment of uncertainty in hydrological calculation, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS
Credits	3	Semester	5
Aim of discipline	Formation of the ability to analyze and process hydrological information, introduces the methods of its automated collection, storage and transmission, as well as teach them various methods of automated processing of hydrological information using a personal computer, methods and means of solving using PC mathematical problems and using it to automate experimental studies .		
Abstract of discipline	Discipline is aimed at understanding the role of hydrological information in monitoring the natural environment, the types and		

	sources of hydrological information; introduces students to the main types of computing technology used in hydrology in different periods; to characterize the device of a personal computer (PC) and the purpose of its main parts; familiarize students with the basic principles of programming; give an idea of the basic principles of collecting, transmitting and storing hydrological information; teach students how to prepare hydrological information for its automated processing; to teach students to various methods of automated processing of hydrological information using a personal computer.		
ELECTIVE COMPONENT – 27 credits			
Module Channel Processes – 6 credits			
Code DChF3225	**Dynamics of channel flow**		
Prerequisites	HM1208 Higher Mathematics, GRH3223 General and river hydraulics	Postrequisites	ChP3226 Channel processes, IMP4232 Introduction to mudflow processes, GARBM4230 Geomorphological approach to river basin management.
Credits	3	Semester	5
Aim of discipline	Formation of the ability to solve problems in the field of kinematics and dynamics of flows and introduces students-hydrologists with the basic concepts and provisions of the dynamics of flows		
Abstract of discipline	Discipline is aimed at the formation of knowledge of the turbulent flow, the laws of velocity distribution in the channel flow, the mechanical composition and hydraulic properties of sediments, the interaction of the channel flow and sediments, the main types of channel processes, methods for assessing the stability of river channels, the impact of economic activity on the channel processes		
Code ChP3226	**Channel processes**		
Prerequisite	HM1208 Higher Mathematics, GRH3223 General and river hydraulics DChF3225 Dynamics of channel flow	Prerequisite	IMP4232 Introduction to mudflow processes
Credits	3	Semester	6
Aim of discipline	Formation of the ability to solve problems in the field of kinematics with a hard and deformable bed and introduces the hydrology students with the basic concepts and provisions of the channel processes.		
Abstract of discipline	Discipline forms knowledge of hydromechanical theory of channel processes, characteristics of river soils (bottom sediments.		

	Hydraulic strength of bottom sediments is considered; Theory of suspended sediments by turbulent flow of water; Interchange of turbulent suspended flow and sediment flow; sediment attraction elements.		
Module GIS technology in hydrology - 6 credits			
Code GISH3228	**GIS in Hydrology**		
Prerequisites	ICT1105 Information and Communication Technology; MMSPHI3224 Modern methods of statistical processing of hydrological information	Postrequisites	MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling, MMGFT4232 Mathematical modeling of the groundwater flow and transport
Credits	3	Semester	6
Aim of discipline	Formation of ideas about the possibility of using GIS technologies in hydrological research, existing source data, means of spatial analysis of hydrological information.		
Abstract of discipline	Discipline forms knowledge of geographic information systems and the use of hydrological modular technologies, conclusions, and data visualization, means of access to hydrometeorological databases.		
Code MHPGIS4227	**Modeling of hydrological processes in GIS**		
Prerequisites	ICT1105 Information and Communication Technology; HC3207 Hydrological calculations, MMSPHI3224 Modern methods of statistical processing of hydrological information, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts	Postrequisites	no

Credits	3	Semester	7
Aim of discipline	Formation of a specialist-hydrologist ability to understand the physical nature of hydrological phenomena and processes, to be able to use elements of the mathematical apparatus and methods for calculating and analyzing hydrological processes in water bodies and their interaction with the environment, to correctly choose the necessary set of hydrological characteristics for building models, to evaluate their legitimacy and authenticity.		
Abstract of discipline	Formation of a student's knowledge in the field of modeling hydrological processes occurring in land water bodies, building hydrological models, understanding the general structure of hydrological models and connections of its elements and the essence of building hydrological models. Include the study of new knowledge in the context of basic knowledge of the specialty, interpret its content, analyze the learning situation and suggest the direction of its solution.		
Module Hydrological support of the Economy – 6 credits			
Code HSWC4229	**Hydrological services for the water consumers**		
Prerequisites	AUHC3217 Assessment of uncertainty in hydrological calculation, EWRM 3219 Economics of water resources management, HF3216 Hydrological forecasts	Postrequisites	no
Credits	3	Semester	7
Aim of discipline	Consists in the formation of the ability to assess the degree of influence of hydrometeorological conditions and regime characteristics on the activities of various sectors of the national economy, assess the effectiveness of hydrometeorological support for various sectors of the national economy, and provide recommendations for the selection of optimal economic solutions based on hydrometeorological information and basic calculation schemes.		
Abstract of discipline	Types of hydrological information. Search for an optimal economic solution based on normative and prognostic information. Economic efficiency of hydrological support for national economy. General principles and assessment of economic efficiency in the national		

	economy and results of hydrological studies. Analysis of methods for assessing the economic effectiveness of hydrometeorological support of various agriculture branches.		
Code WASSWT4230	**Water abstraction supply, sanitation and wastewater treatment**		
Prerequisites	HCh2213 Hydrochemistry; HFS3215 Hydrological field survey, EWRM3219 Economics of water resources management, UH3231 Urban hydrology	Postrequisites	no
Credits	3	Semester	7
Aim of discipline	Formation of the student's abilities to orient in the genesis and in the types of wastewater, their origin, composition and physical-chemical indicators; norms and discharges of wastewater, the effects of wastewater and the rationing of water quality in water bodies; study of wastewater treatment methods of different origin, it choice, methods of disposal of precipitation.		
Abstract of discipline	Discipline is aimed at the formation of knowledge about wastewater, their origin, types, composition, and physico-chemical indicators. Norms and expenses of water disposal are also studied, assessment of the impact of wastewater on the state of water resources of the territories and rationing of water quality of water bodies, methods of sewage treatment of different origin, their choice, methods of utilization of sedimentary water and wastewater costs, the effects of waste water and water quality rationing; methods of wastewater treatment of different origin, their choice, methods of disposal of precipitation.		
Module Dangerous hydrological phenomena and hydrology of the seas – 9 credits			
Code WRNH3231	**Water-related natural hazard**		
Prerequisites	GM1203 General meteorology, HM1208 Higher Mathematics, HR1205 Hydrology of rivers, HELR2218	Postrequisites	IMP4232 Introduction to mudflow processes, IRBME4229 Integrated River basin management and Ecohydrology, GARBM4230 Geomorphological approach to river basin management, ECCWM4232 Effects of

	Hydraulic engineering and land reclamation, HSER2233 Hydrology of the seas and estuaries of rivers		climate change on watershed management
Credits	3	Semester	6
Aim of discipline	Formation of students' ability to master with the main tasks in solving hydrological problems associated with dangerous hydrological phenomena: their nature, nature of development, risks and losses from it develop, issues of forecasting and calculating flood characteristics.		
Abstract of discipline	Discipline is aimed at generating knowledge about the types of floods, their classification of floods according to frequency of occurrence, the nature of long waves, risks and damages from dangerous hydrological phenomena. Also considered: direct and indirect damages from floods; spring floods and mash-stopping; flood floods; mudflows and mudflow types; avalanches and their hydrological role; the influence of endogenous factors; issues of hydrological information interpretation; calculations and forecasts of hazardous phenomena.		
Code IMP4232	**Introduction to mudflow processes**		
Prerequisites	GM1203 General meteorology, HFS3215 Hydrological field survey, DChF3225 Dynamics of channel flow, ChP3226 Channel processes, WRNH3231 Water-related natural hazard	Postrequisites	no
Credits	3	Semester	7
Aim of discipline	Formation of abilities to understanding the features of the formation of mudflows, methods of their study, the main mudflow problems and methods for their solution, as well as measures and facilities for the prevention of mudflows and mud protection.		

Abstract of discipline	Discipline is aimed at the formation of knowledge of mudflows, their nature, protective measures, and get acquainted with modern mudflow terminology, acquire skills in calculating the characteristics of mudflows for the design of mudflow structures		
Code HSER2233	**Hydrology of the seas and estuaries of rivers**		
Prerequisites	FH1204 Fundamentals of hydrology, HPh2212 Hydrophysics, RBW1221 River basins of the world	Postrequisites	WRNH3231 Water-related natural hazard, HPCS3228 Hydrodynamic processes of the Caspian Sea
Credits	3	Semester	4
Aim of discipline	Forms the ability to understand general information about the oceans, the physics of the ocean and the seas, the dynamics of the ocean and the seas and the processes at the boundary of land and sea.		
Abstract of discipline	Discipline forms an idea of the physicochemical properties and characteristics of sea water, the main processes occurring in the oceans and seas, the calculation of marine hydrological characteristics and the corresponding graphical construction.		
Module Computer technologies in hydrology – 6 credits			
Code HM4227	**Hydrological modeling**		
Prerequisites	FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, GISH3228 GIS in Hydrology, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS, MMGFT4232 Mathematical modeling of the groundwater	Postrequisites	no

	flow and transport		
Credits	3	Semester	7
Aim of discipline	Formation of the ability to understand the main types and methods of modeling hydrological processes, modeling algorithms and problem statement that requires solving.		
Abstract of discipline	Discipline is aimed at developing skills in applying models of hydrological processes, studying model types, temporal and spatial resolution of models, principles of model calibration and assessment of climate change.		
Code HPCS3228	**Hydrodynamic processes of the Caspian Sea**		
Prerequisites	HPh2212 Hydrophysics, HLR2222 Hydrography of lakes and reservoirs, HSER2233 Hydrology of the seas and estuaries of rivers	Postrequisites	no
Credits	3	Semester	6
Aim of discipline	Formation of the student's ability to independently solve problems related to the hydrodynamic processes of the Caspian Sea according to data on earth and satellite observations.		
Abstract of discipline	Discipline forms knowledge about the hydrological processes of the Caspian Sea and considers the stages of development of long-term and inter-annual fluctuations in the level of the Caspian Sea. Calculations of average annual water levels of the Caspian Sea based on observational data. Construction and analysis of the difference-integral curve of average annual sea levels. Basic principles of operation of the hydrodynamic model MIKE 21. The use of the hydrodynamic model of the Caspian Sea. Basic principles of operation of the wave spectral model SWAN.		
Module Integrated water resources management – 6 credits			
Code IRBME4229	**Integrated River basin management and Ecohydrology**		
Prerequisites	WBS2214 Water balance studies, EWRM 3219 Economics of water resources management, HLR2222	Postrequisites	no

	Hydrography of lakes and reservoirs, HSWC4229 Hydrological services for the water consumers, WRNH3231 Water-related natural hazard, RSGEC3231 River system and global environmental change, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment		
Credits	3	Semester	7
Aim of discipline	Formation to student's ability to identify adverse effects in river basins and create a concept of a sustainable river basin that will provide a balance between the existing natural functions of the river system and the developed aspects of the system, taking into account industrial use, recreation, environmental management and agricultural purposes.		
Abstract of discipline	Discipline forms knowledge of the principles of integrated water resources management (IWRM) in accordance with international standards. Appropriate tools are offered to students to identify potential threats to the aquatic environment and to evaluate the effectiveness of improvement measures.		
Code GARBM4230	**Geomorphological approach to river basin management**		
Prerequisites	GC1211 Geodesy and Cartography, HFS3215 Hydrological field survey, DChF3225 Dynamics of channel flow,	Postrequisites	no

	WRNH3231 Water-related natural hazard		
Credits	3	Semester	7
Aim of discipline	Forms the ability to navigate the latest theoretical and practical developments in the field of river geomorphology and river basin management skills based on World experience and research conducted by the River Basin Research Group and hydrology in the universities of World.		
Abstract of discipline	Discipline is aimed at developing research skills in river basin systems based on case studies and experience examining river systems in Europe, New Zealand, the Mediterranean and South America. Geomorphological procedures that can be used to identify the causes of instability in river catchments and steps that can be taken to eliminate these problems are considered.		
Module Impact of climate change and anthropogenic load on river runoff – 9 credits			
Code RSGEC3231	**River system and global environmental change**		
Prerequisites	WBS2214 Water balance studies, RBW1221 River basins of the world	Postrequisites	IRBME4229 Integrated River basin management and Ecohydrology
Credits	3	Semester	6
Aim of discipline	Formation of the ability to identify and analyze the factors influencing global processes on river systems and to find solutions to problems.		
Abstract of discipline	Discipline builds the ability to critically evaluate and demonstrate evidence on both the written exam and the assessment essay by reading a wide range of relevant literature.		
Code ECCWM4232	**Effects of climate change on watershed management**		
Prerequisites	WBS2214 Water balance studies, HSWC4229 Hydrological services for the water consumers, WRNH3231 Water-related natural hazard	Postrequisites	no
Credits	3	Semester	7

Aim of discipline	Formation of the ability to identify changes in flow patterns and reduce the annual availability of water for the main sectors of the economy, in particular agriculture, forestry, energy supply and drinking water.		
Abstract of discipline	Discipline is focused on studying the effects of climate change on water resources, providing students with the latest information on alternatives and patterns of adaptation to climate change.		
Code PPMTRK2233	**Problem of pollutions of the main transboundary rivers of Kazakhstan**		
Prerequisites	HCh2213 Hydrochemistry, ESD2108 Ecology and sustainable development	Postrequisites	AAIWR4220 Assessment of anthropogenic impacts on water runoff
Credits	3	Semester	4
Aim of discipline	Forms the ability to independently perform calculations of hydrochemical characteristics, will be able to develop new methods for determining the calculated hydrochemical composition, to assess the hydrochemical and environmental conditions of water bodies.		
Abstract of discipline	Discipline is aimed at acquiring skills to calculate the excess of maximum permissible concentrations, maximum permissible concentrations of water bodies for domestic purposes, the regime and characteristics of conditionally natural hydrochemical runoff in the Ertis, Esil, Tobol river basins, calculations of hydrochemical characteristics of rivers in the Balkash-Alakol basin in conditionally natural flow, Shu-Talas basin in the period of conditionally natural stream, mode of determination and characteristics of the natural flow in the Zhaiyk-Caspian basin.		
Module Mathematical modeling of hydrogeological processes and applied issues of hydrology – 9 credits			
Code UH3231	**Urban hydrology**		
Prerequisites	EWRM3219 Economics of water resources management	Postrequisites	AAIWR4220 Assessment of anthropogenic impacts on water runoff, WASSWT4230 Water abstraction supply, sanitation and wastewater treatment
Credits	3	Semester	6
Aim of discipline	Formation of ability in understanding various aspects of urban hydrology and water resource management.		
Abstract of discipline	Discipline forms the skills in urban hydrology, the issues of assessing the risk of storm waters are considered. Overview of		

	storm water system design. Introduction to design programs: AutoCAD. Flood control and climate change in urban hydrology. Urban hydrology in cold climates. Case studies of urban runoff.		
Code MMGFT4232	**Mathematical modeling of the groundwater flow and transport**		
Prerequisites	FH1204 Fundamentals of hydrology, HM1208 Higher Mathematics, WBS2214 Water-balance studies, GISH3228 GIS in Hydrology, MHPGIS4227 Modeling of hydrological processes in GIS, HM4227 Hydrological modeling	Postrequisites	no
Credits	3	Semester	7
Aim of discipline	Forms the ability to analyze the prospects of general mathematical methods used to solve practical problems of groundwater flows and the mass transfer of pollutants in groundwater by solving general flow and mass transport equations.		
Abstract of discipline	Discipline is aimed at using mathematical models in groundwater based on the groundwater flow equation, numerical methods for solving the flow equation, mass transfer equation in groundwater, sources of soil and groundwater pollution, mass transport resolution methods and advanced topics, including inverse modeling and introduction to modeling the interaction of salt water and freshwater.		
Code HP2233	**Hydrological processes**		
Prerequisites	FH1204 Fundamentals of hydrology, HR1205 Hydrology of rivers, HPh2212 Hydrophysics,	Postrequisites	HC3207 Hydrological calculation, HF3216 Hydrological forecasts, MHPGIS4227 Modeling of hydrological processes in GIS

	HCh2213 Hydrochemistry		
Credits	3	Semester	4
Aim of discipline	Forms the ability to understand the hydrological processes, the formulation of water balance equations and the assessment of the elements of the water balance of the catchment area - infiltration and evaporation, in addition to addressing the winter regime and hydrological monitoring on the example of Finland.		
Abstract of discipline	Discipline is aimed at studying the following issues: an introduction to hydrological processes. Equation of catchment and water balance. Soil properties and storage capacity. Infiltration and evaporation. Wastewater processes. Hydrology of the lake and river. Water quality and transportation of suspended solids in surface waters. Hydrological monitoring. Winter mode of the rivers.		

Выписка из протокола № 1
заседания комиссии по направлению подготовки
6В052-Окружающая среда
учебно-методического объединения
Республиканского учебно-методического совета
высшего и послевузовского образования
на базе КазНУ им. аль-Фараби (далее УМО РУМС)
от 20 ноября 2018 г.

ПРИСУТСТВОВАЛИ: Зам. председателя УМО РУМС на базе КазНУ им. аль-Фараби, проректор по учебной работе Хикметов А.К., ученый секретарь УМО РУМС Сыргакбаева А.С., члены комиссии по направлению подготовки 6В052-Окружающая среда.

СЛУШАЛИ:

- Зам. председателя УМО РУМС на базе КазНУ им. аль-Фараби, проректора по учебной работе Хикметова А.К.: В 2018 гг. в соответствии с договором № 183 от 14.05.2018 года КазНУ им. аль-Фараби было поручено разработать 10 образовательных программ на английском языке (далее ОП) в их числе ОП по направлению подготовки 6В052-Окружающая среда: «Гидрология». Слово предоставляется председателю комиссии по направлению подготовки 6В052-Окружающая среда, декану факультета географии и природопользования КазНУ им. аль-Фараби д.г.н., профессору Сальникову В.Г.

- Сальников В.Г.: ОП «Гидрология» была разработана в рамках выполнения пункта 133 Плана мероприятий по реализации Государственной программы развития образования и науки Республики Казахстан на 2016-2019 годы, в соответствии с Законом Республики Казахстан «Об образовании» от 27 июля 2007 года № 319-III, нормативно-правовыми актами МОН РК, с технической спецификацией по разработке образовательных программ на английском языке. В период разработки программы в МОН РК было отправлено 2 промежуточных отчета и драфта ОП – 1 июля 2018 г., 1 октября 2018 г. Все дисциплины и модули ОП были согласованы с ведущими отечественными и зарубежными учеными и экспертами, а также с работодателями.

Слово предоставляется координатору ОП «Гидрология» к.г.н., доценту Абдрахимову Р.Г.

- Абдрахимов Р.Г.: В разработке ОП «Гидрология» участвовали ведущие отечественные и зарубежные специалисты: Сальников В.Г., Абдрахимов Р.Г., Джусупбекова Д.К., Мусина А.К., Жанабаева Ж.А. и др. José Esteban Capilla Roma– профессор, проректор по науке, инновации и трансферу Политехнического университета Валенсии, Испания. Nicola Fohrer – профессор, директор департамента гидрологии и водных ресурсов Института охраны природных ресурсов Кильского Университета, Германия. Bjorn Klove – профессор, директор института водных ресурсов и инжиниринга

окружающей среды Университета Оулу, Финляндия. Mark Graham Macklin – профессор, декан факультета географии, директор Линкольнского центра воды и здоровья человека, Англия. Vitali A. Haustov – к.г.н., доцент, заведующий кафедрой гидрофизики и гидропрогнозов Российского Государственного Гидрометеорологического Университета, Россия. Abror Gafurov – PhD, лектор факультета географии Университета Гумбольдта, Германия. Hörmann Georg Manfred – доктор департамента гидрологии и водных ресурсов Института охраны природных ресурсов Кильского Университета, Германия. Javier Rodrigo Ilarri – ассоциированный профессор Политехнического университета Валенсии, Испания. Manuel Augusto Pulido Velázquez – Директор научно-исследовательского института воды и инжиниринга окружающей среды, Испания. Hani Ahmad Abu Qdais – профессор факультета воды и инженеринга окружающей среды Иорданского университета науки технологии, Иордания. Christian Opp – профессор факультета географии Марбургского университета, Германия. Гани Несипбеков – PhD, директор школы горного дела и наук о Земле, АОО «Назарбаев университет», Казахстан. Активное участие в разработке ОП приняли представители работодателей: Амиргалиев Н.А. д.г.н., профессор, главный научный сотрудник ТОО Институт географии, Казахстан. Бурлибаев М.Ж. д.т.н., профессор, заместитель генерального директора по науке, академик РАВН Казахстанского Агенства по прикладной экологии, Казахстан. Саиров С.Б. – к.г.н., директор филиала РГП «Казгидромет» по г. Алматы, Казахстан. Алимкулов С.К. к.г.н., заместитель директора ТОО Институт географии, Казахстан. Ивкина Н.И. к.г.н., доцент, начальник управления гидрометеорологических исследований Каспийского моря РГП «Казгидромет», Казахстан.

- Хикметов А.К.: ОП «Гидрология» разработана в соответствии с требованиями технической спецификации, структура и содержание ОП согласованы с работодателями, сроки выполнения работ соблюдены. Предлагаю одобрить ОП на английском языке по направлению подготовки 6В052-Окружающая среда: «Гидрология». Прошу коллег высказать свое мнение. Принято единогласно.

ПОСТАНОВИЛИ:

Одобрить образовательную программу «Гидрология» на английском языке по направлению подготовки 6В052-Окружающая среда.

Зам. председателя УМО РУМС
на базе КазНУ им. аль-Фараби,
проректор по учебной работе **А.К. Хикметов**

Председатель комиссии УМО РУМС
по направлению подготовки
6В052-Окружающая среда **В.Г. Сальников**

Ученый секретарь УМО РУМС **А.С. Сыргакбаева**

EXPERTS CONCLUSION

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28. Sept. 2018

PEER REVIEW

to the Educational Program «Hydrology» on the specialty «5B061000-Hydrology» in English for universities of the Republic of Kazakhstan

The Educational Program «Hydrology» on the specialty «5B061000-Hydrology» in English was developed at al-Farabi KazNU within the framework of the grant of the Ministry of Education and Science of the Republic of Kazakhstan with participation specialists from Europe countries, Russia and Kazakhstan in the hydrology field.

The relevance of the Educational Program in English for Kazakhstan

The developed program in English consists of three main sections, including general educational disciplines, basic and profile disciplines, which are consist of disciplines of various specifications collected into the modules. The Educational Program assumes the training of hydrologists in the following main fields: monitoring, assessment of water resources, sustainable use of water resources, engineering hydrology and forecasts of various hydrological processes and integrated management. These areas of training specialists are justified by the development challenges of the republic's economy. In this connection the development and implementation of the Educational Program, taking into account the modern requirements for the training of competitive specialists in hydrology and water resources fields in English, is a necessity and highly relevant at the present time.

Program conformity with international standards of education

The program is developed on the basis of the International Standards of Education and taking into account the training of specialists in the hydrological profile of

Western European countries.

Program conformity with similar hydrological training programs

Training of specialists in the hydrology and water resources fields relates to water management problems, which have to be solved by the government. It has various directions in the professional activities of a hydrologist. In this connection, specialists are being graduated in the fields of hydrology, hydro-geology, surface runoff and erosion processes, melioration, hydraulic engineering, ecohydrology and integrated river basin management, etc. As noted earlier the Meteorology and Hydrology Department is specializes in surface runoff issues. Proceeding from this, the Educational Program consists of disciplines for monitoring, estimating and forecasting the characteristics of surface runoff. In general, the Educational Program contains a number of basic disciplines that are taught by specialists in the hydrological profile in the World practice. In addition, a number of profile disciplines correspond to the content of the disciplines studied in a number of partner universities.

In accordance with the decision of the plenary session held from June 19 to 22 at the al-Farabi KazNU, Kiel University, Department of Hydrology and Water Resources Management offers a number of disciplines that are taught here to students of the hydrological specialization within the international study program of Environmental Management which is embedded into the school of sustainability. Integrated river basin management and ecohydrology will be offered as a compact course and series of 15 lectures and seminars and working topics for the students. The principles of integrated water resource management (IWRM) are conveyed according to international standards. Suitable tools to identify potential threats for the aquatic environment and to assess the effectivity of improving measures are introduced. Case studies for the application of IWRM are presented, and developed by the students in exercises. Key stakeholders have to be identified and considered in the solution process. Students will be able to identify adverse effects in river basins and establish a sustainable river basin concept which provides a balance between the existing natural functions of the river system and the developed aspects of the system considering industrial use, recreation, nature management and agricultural purposes. Civil engineering and nature-based solutions will be discussed and a balanced sustainable concept for the river basin will be developed.

In our opinion, this discipline, which is included in the elective component of basic disciplines of the Educational Program, will allow students of al-Farabi KazNU to receive in-depth and advanced knowledge in integrated river basin management and ecohydrology in the water resources management field. It was compiled according to

the Bologna Process Standards and fulfils all requirement of an in-depth training of young professionals in the area of hydrology.

In conclusion: Proceeding from the foregoing, the Educational Program "Hydrology" on the specialty 5B06100-Hydrology in English corresponds to the State general education standard of this specialty and can be recommended for implementation.

Director of the Institute of Natural Resource Conservation,
Chair of Hydrology and Water Resources Management
at CAU Kiel, Germany

(Prof. Dr. Nicola Fohrer)
Work position

Prof. Dr. Nicola Fohrer
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Signature stamp

PEER REVIEW of the Educational Program «Hydrology» on the specialty «5B061000-Hydrology» in English for universities of the Republic of Kazakhstan

This expert report is issued and signed by Professor José E Capilla, from his position as professor of Applied Physics and of Water and Environmental Engineering at the Technical University of Valencia, Spain. The report is based on the study of the available documentation provided by KazNU faculties and the meetings held during the working visit to KazNU in June of 2018.

General considerations

The current Educational Program was developed by the Department of Meteorology and Hydrology of the Faculty of Geography and Environmental Sciences of al-Farabi KazNU within the framework of the grant of the Ministry of Education and Science of the Republic of Kazakhstan with participation of foreign, russian's and kazakhstan's experts in the hydrology field.

The relevance of the educational program in English for Kazakhstan

The program in English is extremely relevant for bachelor's in hydrology, since English is the language of communication of the world scientific community. Mastering the competencies offered in the Program in English will allow graduates to adapt to the new conditions of science and technology development much faster and be aware of the current trends in research in the hydrology field. It will also facilitate the incorporation of the faculties involved in the program to the current state-of-the-art research and technological trends providing great opportunities to the local research development and internationalization of the University.

Program conformity with international standards of education

The program fully complies with international standards of education incorporating the modules and topics regulated by the national legal framework.

Program conformity with similar hydrological training programs

Training of specialists in the water resources field, hydraulic engineering, melioration, hydrogeology, etc. has a wide range of studied disciplines. In this regard, the training in

different universities with some standards has great differences. At the Meteorology and Hydrology Department of al-Farabi KazNU the main direction is the assessment of water resources, their rational use, engineering hydrology and forecasts of various hydrological processes.
This direction is conditioned by the demand and tasks of the main employers of the republic of Kazakhstan. Founded on this basis, the Educational Program also incorporates the general disciplines that are taught in similar programs of European universities of various fields in the area of training specialists in the hydrological profile. In particular, at UPV, such disciplines as hydrometrics, hydrologic engineering, hydrogeology, general hydrology, GIS in hydrology, modelling of hydrological processes and forecasts of their development are included in the training of specialists in various fields: hydrogeology, ecology, hydrotechnics.

Thus, in general, the training of a specialist in the hydrology field has a wide range of directions, and the specialization of Educational Program are different and cannot be the same. The fundamental disciplines studied in the world practice in the training of specialists of hydrological profile are included into the Hydrology Educational Program.

Demand of graduates in the labour market

Based on the learning outcomes of the education of the Educational Program and on the assumption of the feedback of employers, which mentioned in the speeches of representatives of employers in plenary sessions from June 19 to 22 at al-Farabi KazNU, the Meteorology and hydrology department is fully provides the demand for graduates of the organizations of the Republic of Kazakhstan. Due to the transition to a new Educational Program in English, the in-demand on the labour market of graduates will increase, there will be new opportunities to realize themselves as a specialist in foreign organizations of a hydrological profile, or they will continue their education in foreign universities at higher levels of education.

Proposals for improving the program taking into account the requirements of the qualification characteristics of a specialist

In accordance with the decision of the plenary session held from June 19 to 22 at the al-Farabi KazNU, the UPV offers a number of disciplines that are teaching to students of the hydrological profile at UPV. The working group of developers of the Educational Program with consisting of: Jose E. Capilla Roma, Nicola Fohrer, Bjorn Klove, Mark G. Macklin, Abror Gafurov and others included in the Educational Program the following disciplines of UPV educational programs in the areas of hydrological profile:

a) Mathematical modelling of groundwater flow and transport - Jose Capilla;

b) Groundwater Hydrology - Javier Rodrigo;
c) Soil and groundwater pollution - Javier Rodrigo;
d) Effects of climatic change on watershed management - Manuel Pulido;
e) Water economy - Manuel Pulido.

In our opinion, these disciplines, which are included in the elective component of basic and profiling disciplines of the Educational Program, will allow students of al-Farabi KazNU to receive in-depth and advanced knowledge in hydrogeology, hydrological processes modelling and economic knowledge in the water resources management field.

Additionally, the signing expert recommends to analyse the future implementation of methods to promote the education in transversal competences like critical thinking, work group, leadership, oral communication, entrepreneurship, synthesis and analytical skills, etc with are becoming crucial skills to face the fast changes occurring in water science and technology.

In conclusion:

Based on the above considerations, the Educational Program "Hydrology" on the specialty 5B06100-Hydrology in English corresponds to the general State of educational standards of this specialty and can be recommended for implementation.

Professor José E Capilla Romá
Vice-rector for Research, Innovation and Transfer
Technical University of Valencia, Spain

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To
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Named after Al-Farabi
Faculty of Hydrometeorology
Department Hydrology

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Potsdam, 23 November 2018

Ref. Expert Opinion

During July 2-5, 2018, I was invited as an international expert to review the academic program of the hydrology department of National University of Kazakhstan (KazNU) named after Al-Farabi in Almaty, Kazakhstan. My opinion and review concludes following points:

1. Some of the topics offered in the academic program are outdated and KazNU is trying its best to renew or modernize them.
2. There is a high interest of the department to include new topics into the program that includes new methodologies and tools
3. We have concluded to further cooperate in the future with the involvement of some topics offered from the western universities.

Overall, I very much praise the inititative of KazNU to renew and extend their academic curricular by involving new topics with the help of international experts. This will have a lot of positive implications to the future development of KazNU from both sides, the educational development and also the scientific development.

Dr. Abror Gafurov

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EXPERT REVIEW
TO THE EDUCATIONAL PROGRAM "HYDROLOGY"
IN THE SPECIALTY OF THE BACHELOR DEGREE "5B061000-HYDROLOGY" IN ENGLISH

General characteristics of the educational program. The following materials are submitted for examination: the Passport of the Educational Program (PEP), the Basic Curriculum (BC) of the specialty. The current educational program provides modular training, which includes:

Module of social and humanitarian
Instrumental Module
Module of Social-Political Knowledge
Ecological Module
Professional language Module
STEM-module
Module Physical-geographic aspects in hydrology
Module Physical-chemical aspects in hydrology
Module Measuring means and methods and mathematical processing
Module Theoretical and practical aspects in hydrology
Module Theoretical aspects in hydrology
Module Fundamentals of Hydrogeology
Module Solution of water management issues
Module Management of water resources of basin systems
Module Global hydrology and hydrology of reservoirs
Module Hydrological regime of water bodies under conditions of climate change and anthropogenic loads
Module Channel Processes
Module Applied Aspects in Hydrology
Module Hydrological support of the Economy
Module Modeling of natural processes in hydrology

Module Dangerous hydrological phenomena
Module Computer technologies in hydrology
Module of professional practice

The relevance of the educational program

The relevance of this program is the training of highly qualified hydrologists on the basis of the world teaching practice in English by using modern methods. It covers all components necessary for a modern education in hydrology.

Evaluation of the significance and practical value of the educational program

The proposed program provides a good, sound and modern overview of hydrology and is well suited for the purpose.

Proposals for improving the program, taking into account the requirements of the qualification characteristics of a specialist.

The program provides a very strict schedule, I would propose to give the students more freedom towards the end of the study for their own work.

- writing and defense of the diploma work covers only 4 weeks – this is a very limited time and should be at least 12 weeks. With 4 weeks only, practical projects will not be possible, maybe the module "undergraduate" practice and "industry practice" can be used for the practical part of the thesis.
- hydrologic modelling is an essential part of modern hydrology and should be covered by a module, maybe linked to project work – a possible title could be "applied integrated hydrologic modelling".
- I would suggest the installation of a "training catchment" located near the university, where the students can work on practical and theoretical problems and where a data base for analysis and modeling can be built.
- "foreign language" is taught only in the first semesters. I would suggest a small module where students have to read and discuss a scientific paper in English, this would make it easier for the students to understand papers, get an overview of the current state of science and use them for their final thesis.
- in many modules there seem to be more lectures than practice/seminars, e.g. in hydrometry there are 2 hours of lecture and 1 hour of laboratory, this should be shifted more towards practical parts.
- I would also suggest to streamline the practical computer exercises and take care that there is a common policy of the software and methods to use. I found it very practical to use only open source software and to encourage students to use their own computers (BYOD-policy, bring you own device).

Conclusions: the educational program "Hydrology" on specialty 5B061000 - "Hydrology" corresponds to the requirements of training a specialist hydrologist.

Expertise by:

Work position	Signature stamp	first name and family/surname
Senior scientist	Institut für Natur- und Ressourcenschutz CAU Kiel Olshausenstraße 40 D-24098 Kiel Telefon 0431 / 880 - 40 30	Georg HÖRMANN

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Az.: Hydrology Edu-Progr._Eval-Opp
Marburg, 1. November 2018

Expert evaluation on the educational program «Hydrology» in specialty «5B061000-Hydrology» in English

The composition and the main provisions of the educational program

The educational program "Hydrology" in English consists of the following educational-methodical materials:

- Passport of the educational program (PEP);
- The main curriculum of specialty (MC);
- Catalog of disciplines (CD);
- Educational and methodical complexes of disciplines (EMCD).

These materials include the full complex of educational and methodological documentation for the training of highly qualified specialists in the hydrological profile in the field of surface water hydrology - monitoring of the water regime characteristics, engineering hydrology, rational use of surface waters, forecasting elements of the hydrological regime of rivers.

In addition, in the educational program great attention is given to courses that relate to mountain hydrology and hydro-ecology.

In general, the educational program contains a whole complex of courses, allow to preparing a hydrologist with the necessary knowledge for professional activities in organizations of the Republic of Kazakhstan.

The basic curriculum of the educational program provides training on credit technology, and the disciplines are combined into three parts which including 19 modules.

The educational program was prepared at the Department of Meteorology and Hydrology of the Al-Farabi Kazakh National University with the participation of university partners.

The relevance and novelty of the educational program

The educational program "Hydrology" in English is compiled based on the experience of training specialists in the hydrological profile of European countries for which English is not native, except for England. For example, the process of providing education in English in Germany is currently ongoing. In this regard, I am pleased that specialists from German universities participated in the preparation of the educational program.

Education in English, in the language of international education contributes to the expansion of scientific boundaries, increasing the amount of information and the ability of graduates to be in the professional information field. English is a basic prerequisite to make the students able to read scientific literature in English. This ability is very important. Also oral training presentations in English and training to write a manuscript could be extend the competences of the students.
However, the understanding of the high quality content of all parts of the Hydrology Modules might be better in Russian language (and of course in Kazakh language for native Kazakh speaking people). In Germany, in my faculty we have the status, that normal seminars and lectures and laboratory as well as field practices (or internships) are running in German, when we have only German speaking students. Often we have a few students from abroad, for instance from China or Russia. But these foreign students come to Germany for improving their knowledge of German language. That is why they want to hear German in the courses.

The practical significance of the educational program
The positive aspects of examination of the educational program include the participation in its development of specialists from the organization and scientific institutions of the Republic of Kazakhstan who are employers for graduates of the specialty. The participation of partners from the production allowed forming an educational program taking into account the needs for specializations of future specialists, and in the future to provide them work.

Suggestions and comments
The educational program consists of a large number of disciplines, is sufficiently laborious, and requires intensive work from the students, while we believe that the time allotted for professional practice takes is short in relation to classroom work time. Professional skills must be acquired in the educational process on in production which the future specialist plans to work.
How do you plan the realization possibilities of the Module of professional practice?
I see practices (or internships) in practice and industry water relevant companies in Kazakhstan.
I see another option to realize the practice or internships abroad (for instance in other Central Asia countries, in Russia or in Europe, for instance Germany.
And I see another option to realize the practice or internships abroad in universities, for instance in our university by the MoU between our universities and faculties.
I recommend you to fix these options. In this case the students can select, what is convenient and useful for them.

Conclusions: the educational program "Hydrology" in English on the specialty "5B061000-Hydrology" corresponds to the requirements of the training of a specialist hydrologist.

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Prof. Dr. Christian Opp

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جامعة العلوم والتكنولوجيا الأردنية
كليـــة الهندســـة

ص.ب (٣٠٣٠) اربد (٢٢١١٠) الأردن
هاتف ٧٢٠١٠٠٠ (٢-٩٦٢) فاكس ٧٢٠١٠٧٤ (٢-٩٦٢)

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Expert Evaluation
of the educational program «Hydrology», developed by Al-Farabi KazNU in the framework of the bachelor specialty «5B061000-Hydrology» in English

1. General characteristics of the educational program

The main objective of this report is to give an expert opinion on the educational program «Hydrology» in English developed by the Department of Meteorology and Hydrology of Al-Farabi Kazakh National University with the participation of specialists from professional organizations, scientists and professors of the European Union countries and Jordan. The program will lead to the award of Bachelor Degree in Hydrology. The evaluation was conducted based on the following documents that were provided by Al-Farabi Kazakh National University:

1. Passport of the educational program (PEP);
2. The main curriculum (MC) of specialty;
3. Catalog of disciplines (CD);
4. Educational and methodical complexes of disciplines (EMCD)

The program educational contents and structure were developed based on the State Standards of the Republic of Kazakhstan and the experience of training specialists in the hydrology and water resources fields of the developed countries.

The educational program "Hydrology" in English is designed for modular training. The proposed program flexible, where it contains compulsory as well, as elective courses, which gives the students who will be graduated from the program the possibility to be specialized in various areas and directions of water resources and hydrology. Furthermore, the program structure took into consideration the recent advances in the research and development in the field of Hydrology, as well as the feedback from employers. In addition, renowned academicians and researchers from well-known universities and research centers in Spain, Germany, Finland, England, Jordan and Russia took part in developing the program courses and contents.

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The educational process is supposed to be organized according to the credit system, which is applied by many universities worldwide, giving a more flexible and creative approaches for the graduates of the program depending on changing needs and requirements of specialist by the market.

2. The relevance and significance of the educational program "Hydrology" in English

In world practice the training of hydrological specialists is determined by the tasks of scientific and production activities and the economic demands of the country. at Al-Farabi Kazakh National University the choice of directions and the disciplines list is compiled at the request of major employers for specialists and priority research in the hydrology and water resources fields for the future determined by the National Academy of Sciences and the Ministry of Education and Science of the Republic of Kazakhstan.

A distinctive feature of scientific interests is the assessment of the regime characteristics of river runoff in arid areas; the presence in the republic of mountain ranges sets the study priorities into mudflow processes, glacial runoff, as well as changes in the water balance elements depending on changing climatic characteristics.

Based on these disciplines tasks of the educational program will help future hydrologists of the republic in their professional activities. It is of great importance to organize the educational process in English with the involvement of leading experts from the developed countries of the world, which will undoubtedly make it possible to navigate in new research methods and gain experience in world practice in the hydrology field, as well as giving the program an international flavor that will attract students from outside Kazakhstan.

The expected learning outcomes adduced in the Passport of the educational program corresponds to the generally accepted requirements of hydrological specialists.

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3. Suggestions for the improvement of the educational program.

By reviewing the program contents, it is recommended to consider the following courses as part of the program study plan (They can be developed by Professor Abu Qdais Hani):

1. Urban Hydrology
2. Coastal Hydrology
3. Hydrology of Arid Regions and Drought
4. Integrated Water Resources Management

As the teaching language of the program is the English language, it is doubtful that this program could be implemented soon by the staff of the Department of Meteorology and Hydrology, as not all the faculty members of the Department speaking fluent English. However, the involvement of the foreign professors whose educational and methodological programs of disciplines are included in the main curriculum of the educational program will help in the future to organize the educational process of this educational program in English.

It is recommended that Department staff should improve their English language skills.

Conclusions: the educational program "Hydrology" in English on the specialty "5B061000-Hydrology" corresponds to the requirements of the training of a specialist-hydrologist.

Expertize conducted:

Position, regalia	**Signature stamp**	**Full Name**
Professor of Water and Environmental Engineering	Jordan University of Science & Technology Dept of Civil Engineering	Hani Abu Qdais

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EXPERT REPORT

CONCERNING THE BSc EDUCATIONAL PROGRAMME 5B061000 – "HYDROLOGY"

1.- GENERAL CONSIDERATIONS

The content of the Core Curriculum on Specialty Hydrology (5B061000) shows clearly the willing of KazNU to provide bachelor students on the training of highly qualified specialists in the hydrology field, who possess certain knowledge and competencies that are in demand on the labor market.

The objectives of the educational program are:

- ensure the training of competitive specialists with sufficient knowledge in the hydrology field, formulate production tasks in a professional language and solve problems using modern technologies that have an active civil position

- provide tools for the acquisition of a complex of knowledge that is the basis of this specialty, skills and abilities that allow the students to navigate in the flow of information and receive new knowledge for continuing education in the Master's and PhD's program.

Considering the existence of obligatory disciplines such as "Hydrophysics" and "Hydrochemistry" and elective disciplines such as "Hydrology of rivers", "Groundwater Hydrology", "Soil and groundwater pollution" or "Economics of water resources management", in my opinion the KazNU BSc Educational Programme in "Hydrology" provides a really interesting option for new students who are interested on developing a professional life on this field.

2.- STRUCTURE OF THE CURRICULUM

The Core Curriculum on Specialty Hydrology (5B061000) is organized as follows:

1. **General Education Disciplines (30 credits)**
   - Obligatory Components (21 credits)
     - Social and humanitarian module (6 credits)
     - Instrumental module (15 credits)
   - Elective Components (9 credits)
     - Module of socio-political knowledge (5 credits)
     - Ecological module (4 credits)

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2. **Basic Disciplines (70 credits)**
   - Obligatory Components (49 credits)
     - Professional Language (4 credits)
     - STEM Module (6 credits)
     - Module Physical-geographic aspects in hydrology (10 credits)
     - Module Physical-chemical aspects in hydrology (5 credits)
     - Module Measuring means and methods and mathematical processing (9 credits)
     - Module Calculating and practical aspects in hydrology (15 credits)
   - Elective Components (21 credits)
     - Module Theoretical aspects in hydrology (6 credits)
     - Module Fundamentals of Hydrogeology (6 credits)
     - Module Solution of water management issues (9 credits)
     - Module Management of water resources of basin systems (9 credits)
     - Module Global hydrology and hydrology of reservoirs (6 credits)
     - Module Hydrological regime of water bodies under conditions of climate change and anthropogenic loads (6 credits)

3. **Profile Disciplines (30 credits)**
   - Obligatory Components (18 credits)
     - Module Channel Processes (6 credits)
     - Module Applied Aspects in Hydrology (6 credits)Module GIS technology in hydrology (6 credits)
   - Elective Components (12 credits)
     - Module Hydrological support of the Economy (6 credits)
     - Module Modeling of natural processes in hydrology (6 credits)
     - Module Dangerous hydrological phenomena (6 credits)
     - Module Computer technologies in hydrology (6 credits)

4. **Additional Types of Training (26 credits)**
     - Physical Training Module (8 credits)
     - Professional Practice Module (18 credits)

5. **Final Examination (3 credits)**

TOTAL Number of credits = 159

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In my opinion, the structure of the Core Curriculum is complex and ambitious. The existence of many elective disciplines provides the opportunity that many potential students could be interested in joining the Programme. The curriculum structure is very interesting and attractive to a potential high number of students, both from Kazakhstan and the rest of Central Asian countries.

3.- RECOMMENDATIONS

After the analysis of the Core Curriculum, the following recommendations arise:

- The curriculum includes 57 different disciplines and many of them consider the use of laboratories an seminars. The use of laboratories is highly recommended to BSc students as it allow them to use special resources which are very important on Hydrological Science (computers, chemical reactives, special equipment, …)
- Basic disciplines such as mathematics or physics are important to BSc students as they provide them a basis for future scientific knowledge. I have checked that they have been included on the first Semester as Obligatory disciplines. The integration on the curriculum of posterior elective disciplines such as numerical modelling or Advanced Physics should be considered.
- An elective course of Basic Statistics might be included on the second year, once the students have passed the mathematics and physics courses. This course may be an introduction to the advanced obligatory course on "Statistics and information technology in hydrology" that is considered on the 5th Semester.
- In my opinion some of the Obligatory Components Modules (21 credits) are focused on topics which are not in relation with the BSc in Hydrology:
    - Modern history of Kazakhstan (3 credits)
    - Philosophy (3 credits)
    - Kazakh (Russian) Language (6 credits)
- It should be clarified which is the foreign language being taught in discipline "Foreign Language". I strongly recommend that this disciplined is changed for "English for Science" or a similar one.
- Following the current structure of the Core Curriculum, in order to obtain the BSc diploma students must select a group of 21 credits of Elective Components of Basic Disciplines. There are 6 different modules to choose from. Some strategies should be implemented to ensure an approximate equal number of students in all the 6 modules.

4.- FINAL REMARKS

Being this programme taught exclusively in English language, a high skill of use of this language is expected both from students and professors. The experience in Spain about this topic is extremely positive but many difficulties will arise when implementing the programme at the beginning.

It is absolutely necessary that the professors compromise to provide all the documentation of the disciplines in English language and the students communicate both with professors and other students also in English.

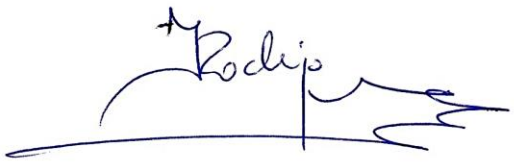
Therefore, students who obtain the BSc in Hydrology are expected to have a high level of English skills and will obtain a very high level of understanding of the main environmental problems and they are expected to join the market both on private companies and public administration soon after leaving the University.

It is strongly recommended that the University provides the convenient support to the students, so there is a special communication between the University and the private companies. The promotion of Intership and Industrial Placement Programmes for BsC in Hydrology is strongly recommended.

Do not hesitate to contacting me for further comments about this report. I will be delighted to cooperate with you on the development of this interesting programme.

Yours sincerely,

Valencia, October 3rd 2018



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Valencia (Spain), September 27, 2018

PEER REVIEW

to the Educational Program **«Hydrology»** on the specialty **«5B061000-Hydrology»** in English for universities of the Republic of Kazakhstan

The Educational Program **«Hydrology»** on the specialty **«5B061000-Hydrology»** in English was developed at al-Farabi KazNU within the framework of the grant of the Ministry of Education and Science of the Republic of Kazakhstan with participation specialists from Europe countries, Russia and Kazakhstan in the hydrology field.

The relevance of the Educational Program in English for Kazakhstan

The developed program in English consists of three main sections, including general educational disciplines, basic and profile disciplines, which are consist of disciplines of various specifications collected into the modules. The Educational Program assumes the training of hydrologists in the following main fields: monitoring, assessment of water resources, rational use of water resources, engineering hydrology and forecasts of various hydrological processes. These areas of training specialists are justified by the development challenges of the republic economy. In this connection the development and implementation of the Educational Program, taking into account the modern requirements for the training of competitive specialists in hydrology and water resources fields in English, is a necessary and relevant at the present time.

Program conformity with international standards of education

The program is developed on the basis of the International Standards of Education and taking into account the training of specialists in the hydrological profile of Western European countries.

Program conformity with similar hydrological training programs

Training of specialists in the hydrology and water resources fields are depends on water management problems, which is solved by the government and has various directions in the professional activities of a hydrologist. In this connection, specialists are being graduated in the fields of hydrogeology, surface runoff, melioration, hydraulic engineering, hydroecology, etc. As noted earlier the Meteorology and Hydrology Department is specializes in surface runoff issues. Proceeding from this, the Educational Program consists

of disciplines for monitoring, estimating and forecasting the characteristics of surface runoff. In general, the Educational Program contains a number of basic disciplines that are teaching for specialists in the hydrological profile in the World practice. In addition, a number of profile disciplines correspond to the content of the disciplines studied in a number of universities.

Proposals for improving the program taking into account the requirements of the qualification characteristics of a specialist

In accordance with the decision of the plenary session held from June 19 to 22 at the al-Farabi KazNU, the UPV offers a number of disciplines that are teaching to students of the hydrological profile at UPV. The working group of developers of the Educational Program with consisting of: Jose E. Capilla Roma, Nicola Fohrer, Bjorn Klove, Mark G. Macklin, Abror Gafurov and others included in the Educational Program the following disciplines of UPV educational programs in the areas of hydrological profile: a) Mathematical modeling of groundwater flow and transport - Jose Capilla; b) Groundwater Hydrology - Javier Rodrigo; c) Soil and groundwater pollution - Javier Rodrigo; d) Effects of climatic change on watershed management - Manuel Pulido; e) Water economy - Manuel Pulido.

In our opinion, these disciplines, which are included in the elective component of basic and profiling disciplines of the Educational Program, will allow students of al-Farabi KazNU to receive in-depth and advanced knowledge in hydrogeology and hydrological processes, water resources management, climate change impact and adaptation, and economics of water resources in the water resources management field.

In conclusion: Proceeding from the foregoing, the Educational Program "Hydrology" on the specialty 5B06100-Hydrology in English corresponds to the State general education standard of this specialty and can be recommended for implementation.

Should you require any additional information, please do not hesitate to contact me.

Sincerely,

Manuel Pulido-Velazquez

Professor, Water Resources Engineering

Director of IIAMA, Research Institute for Water and Environmental Engineering

Director of Climate Change Chair at UPV, funded by the regional government of Valencia

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NAZARBAYEV UNIVERSITY
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Dear Professor Abdrakhimov,

Re: Hydrology program – Curriculum Review

Thank you for the invitation to provide some overview commentary on the proposed Hydrology Program at your university. The following are some observations and comments – some quite broad, others more specific – which I hope will assist in developing the curriculum overall.

Overview Comments

- My overall observation is that the proposed curriculum is a very 'traditional" hydrology program which covers the type of content that has been taught in such programs around the world for many decades. However, I believe that in commencing a new program, you have a unique opportunity for change. It would be highly beneficial to be more focused towards the future needs of the hydrological problems to be faced, and some of the new areas and topics that hydrologists will need to be skilled in.
- Is program seeking any international accreditation (e.g. ABET)?

Specific Comments:

- I find Math is being taught only one semester. Considering the emerging application of numerical methods I suggest to students should have a thorough knowledge of Calculus, Linear Algebra and Differential equations.
- Although there is a course in Hydrochemistry, a general introductory level chemistry courses, as well as a course on isotopes and tracers are missing.
- I cannot find any evidence of content addressing sustainability issues.
- There is one semester of course called 'Statistics and information technology in hydrology". However there is no course on programming and data analytics.
- I am concerned that there is insufficient geology and hydrogeology in the Program. Students should be exposed to more information about subsurface media, formation and transport of fluids through porous media and some modelling tools of groundwater movement and transport.
- I like that there is a GIS component in the program, I hope this includes topics of remote sensing and application of satellite images in solving hydrological problems.

I have already mentioned above the need, and great opportunity in framing a new program, to embrace issues of relevance to hydrology in the coming decades. So this should include greater emphasis on innovative thinking, multi-disciplinary approach to hydrological solutions; more focus on new technology opportunities; more opportunity to explore novel hydrological methods; and dealing with the increasing level of automation in hydrometry, the need for hydrologists to be able to understand, monitor and manage automated systems, which includes big data analysis, sophisticated monitoring systems, and different, multi-disciplinary management practices.

Executive director **G. Nessipbekov**

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Шығыс №_____«___»_____20__ж.
Кіріс №_____«___»_____20__ж.

Исход №762 «19» 10 2018г.
Вход №_____«___»_____20__г.

Экспертное заключение
на образовательную программу «Hydrology», разработанной в КазНУ им. аль-Фараби в рамках специальности бакалавриата «5В061000-Гидрология» на английском языке

1. Общая характеристика образовательной программы.

Образовательная программа «Hydrology» на английском языке разработана в соответствии с ГОСО Республики Казахстан, согласована с Дублинскими дескрипторами и Европейской рамкой квалификаций. Данная программа включает все базовые направления знаний по специальности «Гидрология». Последовательность преподаваемых дисциплин хорошо продумана, ранее пройденные дисциплины являются основой для более глубокого изучения различных направленностей специальности.

2. Актуальность образовательной программы «Hydrology» на английском языке.

В современном мире вопрос водообеспеченности имеет важное значение. Для Казахстана – это особый аспект, поскольку большая часть Республики располагается в полуаридной и аридной зоне. Более того, 7 из 8 водохозяйственных бассейнов Республики являются трансграничными, причем наша страна является устьевым или транзитным участками этих бассейнов. Для разрешения споров касательно вододеления с сопредельным государствами созданы международные комиссии. К примеру, переговоры с Китайской Народной Республикой проходят с привлечением переводчиков казахского, русского, китайского языков. Нередко возникают споры по поводу специфической терминологии, интерпретируемые специалистами двух стран по-разному. В таких случаях приходится обращаться к международному словарю ВМО (International Glossary of Hydrology), рабочими языками которого являются английский, французский, русский, испанский. В этом случае специалисту, который обучался на английском языке, будет легче и проще оперировать международной терминологией.

3. Оценка значимости и практической ценности образовательной программы.

Поскольку в современном мире английский язык является языком международного общения, подготовка специалистов-гидрологов на данном

языке дает ряд преимуществ. Бакалавру, завершившему обучение по образовательной программе «Hydrology» на английском языке будет легче поступить в магистратуру и докторантуру PhD зарубежных ВУЗов. Еще одно преимущество состоит в том, что англоязычные студенты смогут учиться в КазНУ им. аль-Фараби по данной специальности, что создаст еще больше возможностей для академической мобильности учащихся.

4. Предложения по совершенствованию программы с учетом требований квалификационных характеристик специалиста.

В качестве рекомендации хотелось бы внести предложение об увеличении длительности прохождения курса «Высшая математика» до 10-15 ECTS, потому как изучение гидрологических процессов – это есть физика природных процессов. Для понимания человечеством этого явления физика природных процессов должна быть объяснена языком математики, т.е. дифференциальными и интегральными уравнениями. К сожалению, современные гидрологи не понимают методов математики.

Необходимо в Программе усилить знания в области оценки влияния гидротехнических сооружений (ГТС) и других водохозяйственных сооружений на естественный гидрологический режим рек и озер.

Усилить знания и в области гидрохимии с точки зрения режимных особенностей рек Республики Казахстан.

5. Выводы: образовательная программа «Hydrology» на английском языке по специальности «5В061000-Гидрология» соответствует требованиям подготовки специалиста гидролога.

Экспертизу провел:
Заместитель Генерального директора
по науке, академик РАВН,
д.т.н., профессор **М. Бурлибаев**

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18.10.2018 № 373/1-15
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Экспертное заключение
на образовательную программу «Hydrology», разработанной в КазНУ им. аль-Фараби в рамках специальности бакалавриата «5В061000 – Гидрология» на английском языке

1. **Общая характеристика образовательной программы на английском языке.**

Настоящая образовательная программа (ОП) по специальности «Hydrology» на английском языке разработана на основе Типового учебного плана по специальности «Гидрология» с учетом сопоставления трудоемкости учебной нагрузки в соответствии с требованиями Болонской декларации.

В разделе 2 Паспорта сделана нормативная ссылка на соответствующий Закон РК, Постановление Правительства и на ряд важных действующих документов, методических руководств в области обучения и подготовки кадров – гидрологов. ОП соответствует ГОСО РК и согласована с Дублинскими дескрипторами и Европейской рамкой квалификации.

Вполне квалифицированно определены приоритетные направления ОП, здесь можно считать важным Послание Президента РК «Третья модернизация Казахстана: глобальная конкурентоспособность», совместные ОП с зарубежными ВУЗами – партнерами. Достаточно четко определены цели ОП, что она ориентирована на подготовку высококвалифицированных и конкурентоспособных специалистов, профессиональное образование которых по данной специальности соответствовало высоким академическим стандартам в мировом образовательном пространстве.

В программе показаны сфера и направления профессиональной деятельности специалиста – гидролога, которыми могут быть научные, образовательные учреждения, государственные органы и хозяйственные организаций.

Указанные выше свидетельствуют о соответствием ОП национальным и международным требованиям и стандартам, уровню МСКО 6. Она разработана с участием специалистов высокой квалификации и имеет современный научно-педагогический уровень.

Данная весьма важная разработка по подготовке квалифицированных гидрологов вполне заслуживает положительной оценки.

2. Актуальность образовательной программы «Hydrology». Актуальность ОП заключается в том, что, во-первых, она имеет приоритетный характер в реализации Послания Президента РК, касающегося вопроса «Третья модернизация Казахстана: глобальная конкурентоспособность». Во-вторых, она направлена на подготовку высококвалифицированных, конкурентоспособных и владеющих знаниями международного уровня специалистов – гидрологов, способных на научной основе решать важнейшие водохозяйственные проблемы страны.

3. **Оценка значительности и практической ценности образовательной программы**. Значимость и практическая ценность ОП определяется тем, что она для обучения гидрологов на английском языке разрабатывается в Казахстане впервые. Она разработана на основе использования отечественного и зарубежного передового опыта и педагогических методов обучения специалистов – гидрологов широкого профиля – в полном соответствии с требованиями международных стандартов. Опыт заслуживает внедрения и широкого распространения среди ВУЗов Казахстана.

4. Предложения по совершенствованию программы с учетом требований квалификационных характеристик специалиста.

Одной из главных разделов науки «Гидрология» является гидрохимия водных ресурсов. В разделах ОП 10 и 12 предусмотрены вопросы, касающиеся гидрохимического режима водных объектов, методов химического анализа, которые должны входить в компетенцию специалиста – гидролога (ПК – 5 и ПК – 6). Рекомендуется сформулировать ПК 7 следующим образом: знание основных методов расчета речного стока воды и химических веществ; основ количественной оценки изменений стока воды и химических соединений; влияния факторов различной хозяйственной деятельности на водный и химический сток.

Известно, что речной сток химических веществ (минеральных солей, биогенных и токсичных соединений) является определяющим фактором формирования в континентальных водоемах качества воды и создания в них биопродукционного потенциала.

5. Выводы: образовательная программа «Hydrology» на английском языке по специальности «5В061000 – Гидрология» соответствует требованиям подготовки специалиста гидролога.

Растаймын география институтының кадр бөлімінің инспекторы
2018 ж. «18» қазан.

Экспертизу провел:

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ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ
ЭНЕРГЕТИКА МИНИСТІРЛІГІ
«ҚАЗГИДРОМЕТ»
ШАРУАШЫЛЫҚ ЖҮРГІЗУ
ҚҰҚЫҒЫНДАҒЫ РЕСПУБЛИКАЛЫҚ
МЕМЛЕКЕТТІК КӘСІПОРНЫНЫҢ
АЛМАТЫ ҚАЛАСЫ
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РЕСПУБЛИКАНСКОГО
ГОСУДАРСТВЕННОГО
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ХОЗЯЙСТВЕННОГО ВЕДЕНИЯ
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15.10.2018 (күні) № 22-01-21/1344 (индекс)

Экспертное заключение
на образовательную программу «Hydrology», разработанной в КазНУ им. аль-Фараби в рамках специальности бакалавриата «5В061000-Гидрология» на английском языке

1. Общая характеристика образовательной программы. Подготовка специалистов-гидрологов в КазНУ имени аль-Фараби осуществляется с 1966 года. С начала организации учебного процесса и до настоящего времени Национальная гидрометеорологическая служба РК в лице РГП «Казгидромет» Министерства энергетики (далее РГП «Казгидромет») является одним из основных работодателей и заинтересованной организацией в высококвалифицированных кадрах. Принимает участие при составлении образовательных программ, которые менялись с учетом требований и задач различных периодов развития Республики Казахстан. В настоящее время на кафедре метеорологии и гидрологии факультета географии и природопользования КазНУ имени аль-Фараби совместно со специалистами РГП «Казгидромет» и других заинтересованных научно-производственных организаций и известных иностранных ученых-педагогов в области гидрологии и водных ресурсов разработана образовательная программа «Hydrology» на английском языке. Данная образовательная программа разработана своевременно. РГП «Казгидромет» сегодня нуждается в организации деятельности своих подразделений на новых, более качественных и современных методах мониторинга, обработки и прогноза гидрологических процессов.

Образовательная программа «Hydrology» на английском языке содержит весь комплекс учебно-методической документации для подготовки высококвалифицированных специалистов.

Образовательная программа «Hydrology» на английском языке состоит из 20 основных и 7 альтернативных модулей и включают дисциплины, рекомендованные специалистами РГП «Казгидромет», а их содержание соответствует современным требованиям. В РГП «Казгидромет» осуществляется переход на новые принципы организации научно-производственной деятельности. В связи с этим разработка образовательной

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программы «Hydrology» на английском языке по специальности «5В061000-Гидрология» в КазНУ имени аль-Фараби с увеличением количества дисциплин, изучающих новые методы и средства исследований в области гидрологии, позволит в будущем решать задачи обеспечения гидрологической информацией потребителей на высоком современном и более качественном уровне.

Актуальность образовательной программы «Hydrology» на английском языке. Организация учебного процесса на английском языке в Республике Казахстан на основании общемировых стандартов и опыта мировой практики подготовки специалистов в настоящее время весьма своевременно. РГП «Казгидромет» нуждается в высококвалифицированных специалистах со знанием английского языка – языка мировой науки и современных принципов организации деятельности Национальных гидрометеорологических служб. Кроме того Национальная гидрометеорологическая служба РК в лице РГП «Казгидромет» является членом ВМО, что требует от наших специалистов кроме профессиональной подготовки, знание современных мировых тенденций и английского языка.

Оценка значимости и практической ценности образовательной программы. Модернизация Национальной гидрометеорологической службы РК предполагает не только обновления материальной базы ее подразделении. Требуется новые подходы в организации и проведения исследовательских, научных и производственных работ. Образовательная программа «Hydrology» на английском языке, в разработке, которой приняли участие специалисты передовых стран Европы, России и Казахстана позволит гидрологам нового поколения поднять уровень деятельности Национальной гидрометеорологической службы РК в соответствии с мировыми стандартами.

Предложения по совершенствованию программы с учетом требований квалификационных характеристик специалиста. Национальная гидрометеорологическая служба РК в лице РГП «Казгидромет» надеется, что и в дальнейшем при внесении изменении и корректировок в образовательную программу наши предложения будут учтены в соответствии с договором на подготовку специалистов-гидрологов между КазНУ имени аль-Фараби и РГП «Казгидромет».

Отмечаем, что следует усовершенствовать организацию производственных практик студентов в подразделениях РГП «Казгидромет».

Выводы: образовательная программа «Hydrology» на английском языке по специальности «5В061000-Гидрология» соответствует требованиям подготовки специалиста гидролога.

Экспертизу провел:

Директор **С. Саиров**

Экспертное заключение
на образовательную программу «Hydrology», разработанной в КазНУ им. аль-Фараби в рамках специальности бакалавриата «5В061000-Гидрология» на английском языке

1. Общая характеристика образовательной программы. Использование опыта ведущих зарубежных стран при подготовке специалистов гидрологов ориентацией дисциплин, в которых предлагается ознакомление студентов с организацией исследований и производственных работ специальности «Гидрология», на современные требования обучения.

В качестве разработчиков программы, кроме отечественных специалистов и преподавателей, приняли участие ведущие специалисты в области гидрологии ВУЗов и научных центров Испании, Германии, Англии, Финляндии и России. Обладая большим опытом и авторитетом в среде гидрологов зарубежные специалисты также представлены в образовательной программе кафедры в качестве потенциальных лекторов, их дисциплины, и в целом УМКД нашли свое место в рабочем учебном плане и планируется привлекать дальних зарубежных преподавателей при ее реализации.

Таким образом организация учебного процесса на английском языке на кафедре метеорологии и гидрологии по специальности 5В061000 - Гидрология должна привести к повышению конкурентоспособных выпускников, а сама организация учебного процесса позволит привлекать большое количество ведущих иностранных специалистов.

2. Практическая ценность образовательной программы.

Институт географии МОН РК является одним из работодателей специалистов гидрологов КазНУ им. аль-Фараби. Со времен открытия кафедры ее выпускники работают в подразделениях института. За данный период Институт неоднократно благодарил КазНУ за качественную и полноценную подготовку специалистов. В настоящее время качество подготовки гидрологов КазНУ заметно выше, чем других ВУЗах Казахстана. Отрадно, что именно КазНУ берется за новое дело – подготовку специалистов на английском языке. Выпускники со знанием английского языка несомненно будут более востребованными, особенно в научных учреждениях.

3. Предложения по совершенствованию программы с учетом требований квалификационных характеристик специалиста.

В процессе подготовке образовательной программы принимали участие и специалисты нашего института. Меморандум между нашими организациями предполагает всестороннюю поддержку и сотрудничество. Ученые университета принимают участие в научных разработках и исследованиях института.

Специалисты института также принимают участие в организации учебного процесса кафедры метеорологии и гидрологии. Дисциплины и современные направления исследовательской работы и их методы предложенные институтом были учтены при разработке данной образовательной программы. Необходимо и в дальнейшем сотрудничать при

разработке образовательной программы подготовки специалистов гидрологов и научной деятельности института.

4. Выводы: образовательная программа «Hydrology» на английском языке по специальности «5В061000-Гидрология» соответствует требованиям подготовки специалиста гидролога.

Экспертизу провел:

Заместитель директора
Института географии МОН РК **С.К. Алимкулов**

подпись, печать

Экспертное заключение
на образовательную программу «Hydrology», разработанной
в КазНУ им. аль-Фараби в рамках специальности бакалавриата
«5В061000-Гидрология» на английском языке

1. Общая характеристика образовательной программы

Образовательная программа «Hydrology» на английском языке разработана на основании Государственных стандартов Республики Казахстан и опыта подготовки специалистов в области гидрологии и водных ресурсов стран, описывает общие требования к результатам освоения программы, соответствующим характеристике будущей профессиональной деятельности выпускника, а также модульную структуру и условия реализации образовательной программы.

Программа разработана на кафедре метеорологии и гидрологии КазНУ имени аль-Фараби при участии специалистов профессиональных организаций, ученых и педагогов стран Европейского содружества и содержит следующие документы:

1. Паспорт образовательной программы (ОП);
2. Основной учебный план (ОУП) специальности;
3. Каталог дисциплин (КД);
4. Учебно-методические комплексы дисциплин (УМКД).

Модули составлены по направлениям исследований и объектов изучения дисциплин и предполагают освоение теоретических основ и нормативных документов в области гидрологии; формирование знаний, умений и навыков получения и обработки гидрологической информации; знакомство с современными устройствами и методами получения гидрологической информации.

Помимо обязательных предметов, достаточное количество дисциплин по выбору студента, в зависимости от дальнейшей его специализации.

По результатам освоения дисциплины «Hydrology» будут сформированы профессиональных компетенции, а именно:

- способность обеспечивать требуемое качество выполняемых работ и рациональное использование ресурсов:
- способность обеспечивать качество гидрологических измерений и расчетов;
- способность проводить изыскания по оценке состояния природных и природно-техногенных объектов для обоснования принимаемых решений при проектировании объектов природообустройства и водопользования;
- способность использовать знания по гидрологии для обоснования принимаемых решений при проектировании объектов природообустройства и водопользования.

Ряд элективных дисциплин представлены учебно-методическими комплексами, которые разработаны специалистами гидрологического профиля организаций работодателей и известными учеными-педагогами

ВУЗов и научно-исследовательских центров Испании, Германии, Финляндии, Англии, России.

Учебный процесс предполагается организовать по кредитной технологии.

Актуальность и значимость образовательной программы «Hydrology» на английском языке

В мировой практике подготовка специалистов гидрологического профиля определяется задачами научной и производственной деятельности и экономическими потребностями страны. В КазНУ имени аль-Фараби выбор направлений и перечень дисциплин составляется по заявкам основных работодателей на специалистов и приоритетных исследований в области гидрологии и водных ресурсов, определяемых Национальной Академией наук и Министерством образования и науки РК на перспективу.

Отличительной особенностью научных интересов является способность ориентироваться в базовых гидрологических теориях и применять их в проведении комплексных исследований вод суши, форм их существования в природе, свойств, состава, качества, режима, закономерностей распределения в пространстве, взаимосвязей с атмосферой, океаном, литосферой и биосферой в процессе общего и регионального круговорота вещества и энергии; для анализа физических, химических и биологических процессах, протекающих в различных водных объектах суши; анализа проблем водных ресурсов, оценка и прогноз их количественных и качественных изменений, вызванных естественными и антропогенными причинами.

Исходя из данных задач дисциплины образовательной программы помогут будущим гидрологам республики в профессиональной деятельности. Особенно важным считаю организацию учебного процесса на английском языке с привлечением ведущих специалистов передовых стран мира, что несомненно позволит ориентироваться в новых методах исследований и приобрести опыт мировой практики в области гидрологии.

Приведенные в Паспорте образовательной программы ожидаемые результаты обучения соответствует общепринятым требованиям специалистам-гидрологам. Образовательная программа реализуется через систему модулей, каждый из которых представляет собой логически завершенную по содержанию, методическому обеспечению самостоятельную учебную единицу, ориентированную на формирование целостной группы взаимосвязанных компетенций, относящихся к конкретному результату обучения.

Предложения по совершенствованию образовательной программы

Республика Казахстан является членов Международной морской организации, которая является специализированным учреждением ООН. Наиболее важной задачей её деятельности является безопасность на море в соответствии с Международной конвенцией по охране человеческой жизни на море. Для решения этой задачи возникает потребность в специалистах, способных исследовать и прогнозировать опасные гидродинамические

процессы на Каспийском море. Запуск мультимодального хаба-порта Курык, который открывает новые транспортно-логистические возможности для всех стран региона и расширяет международное сотрудничество. Всвязи с этим возникает потребность в специалистах, владеющих терминологией на английском языке. В связи с этим представляется актуальным введение в учебный процесс дисциплины «Гидродинамические процессы Каспийского моря».

Целью данной дисциплины является формирование у студентов набора знаний по гидрологии Каспийского моря. Полученные навыки будут использованы выпускниками для решения задач по исследованию и прогнозированию динамических процессов в научных исследованиях и оперативном производстве.

Выводы: образовательная программа «Hydrology» на английском языке по специальности «5В061000-Гидрология» соответствует требованиям подготовки специалиста гидролога.

Экспертизу провела:

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