



NCJSC «L.N. GUMILYOV EURASIAN NATIONAL UNIVERSITY»

**Module Handbook
Educational program
6B05401 Mathematics (Ba)**

**Nur-Sultan
2022**

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Module 1

Module code and name	HIST 11001 Modern history of Kazakhstan.
Semester(s) when the Module is taught	1
Lecturer	Kushenova G.I.
Connection with the curriculum (cycle, component)	General educational (required component).
Teaching methods	Problem learning.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the Module	School course of History of Kazakhstan.
Module objectives/intended learning outcomes	<p>The purpose of the course is to form a system of scientific views on the history of modern Kazakhstani society in the context of the world historical process. Expected learning outcomes:</p> <ul style="list-style-type: none"> - to systematize the conceptual foundations for studying the modern history of Kazakhstan; compare ideas about the continuity and continuity of historical and cultural development, the deep roots of the spiritual heritage of Kazakhstan; - reveal the significance of the formation of historical consciousness and worldviews in accordance with national priorities; - to classify historical sources reflecting the features of the modern history of Kazakhstan; - to identify the historical patterns of the development of society, paying attention to the study of historical originality; - master the techniques of historical description and analysis of the causes and consequences of the events of the modern history of Kazakhstan; - predict possible solutions to modern problems based on the analysis of the historical past and reasoned information; - to argue the features and significance of the modern Kazakh model of development; - explain the importance of educating patriotism in the spirit of the democratic values of modern society using the example of the life of historical figures.
Content of the Module	<p>Introduction to the course. Kazakhstan on the way to independence: stages of formation of the idea of a national state. Civil-political confrontation. Implementation of the Soviet model of state building. Contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the twentieth century. Formation of the state structure of the Republic of Kazakhstan. Kazakhstani model of economic development. Social modernization is the basis for the well-being of society. Ethno-demographic processes and strengthening of interethnic harmony. Prospects for socio-political development and spiritual modernization. The policy of forming a new historical consciousness and worldview of the peoples of the Great Steppe. Kazakhstan is a state recognized by the modern world. Nazarbayev is a personality in history.</p> <p>Formation of a nation of a single future.</p>
Examination forms	At the end of the semester, the State Oral Examination is held. Exam tickets are used to pass the state exam.
Study and examination requirements	The activity of students in the educational process is obligatory, which is evaluated by the quality of implementation. Attendance at classes and participation in the educational process are mandatory. Students should not be absent from class without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical and electronic learning tools	Projector for presentation.

Reading list	<p>1. Ayagan B.G., Abzhanov Kh.M., Seliverstov S.V., Bekenova M.S. Modern history of Kazakhstan: Almaty: Raritet, 2010. - 432 p.,</p> <p>2. Kan G.V. History of Kazakhstan: Textbook for universities. - Almaty, 2005. - 232 p.,</p> <p>3. History of the Great Steppe: textbook / Kan G.V., Tugzhanov E.L. - Astana: Zhasyl Orda, 2015. - 328 p.</p> <p>4. Momynova Sh.R. Kazakhstan: ancient, ancient and medieval history. In 2 volumes. - Karaganda, 2018 - 342 p.,</p> <p>5. History of Kazakhstan. 5 volumes. 1-5-tomdar. - Almaty., 1996, 1997, 2000, 2010.</p>
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Module 2

Module code and name	ENGL 11103-11203 Foreign language
Semester(s) when the Module is taught	1/2
Lecturer	Ustelimova N.A.
Connection with the curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours- 1 sem., (300 hours per year). Practical: 45 hours -1 sem., (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the Module	To master this module, there is a need of the knowledge, skills and abilities acquired in the course of studying the following courses: Foreign language I (English) minimum sufficient level (A1, common European competence).
Module objectives/intended learning outcomes	<p>The purpose of the module is the formation of intercultural and communicative competence of students of non-linguistic specialties in the process of foreign language education at a sufficient level (A2) of the OEK / at the level of basic sufficiency (B1) of the OEK.</p> <p>Expected learning outcomes:</p> <ul style="list-style-type: none"> - reveals the patterns of development of a foreign language, paying attention to the study of stylistic originality; - compares and selects the forms and types of speech / communication that correspond to the communicative intention with a logical construction adequate to the type of speech and adequately expresses their own communicative intentions with the correct selection and appropriate use of the necessary language means, taking into account their compliance with the socio-cultural norms of the language being studied; - owns the strategy and tactics of constructing a written communicative act, correctly forms speech in writing, based on lexical sufficiency within the framework of speech topics and grammatical correctness; - systematizes the conceptual foundations for understanding the partner's communicative intentions at this level; - owns the techniques of linguistic description and analysis of the causes and consequences of events in scientific and social texts;
Content of the Module	<p>Social sphere of communication: Family in modern society. Socio-cultural sphere of communication: Entertainment. Socio-cultural sphere of communication. Self care. Sociocultural sphere of communication: cultural and historical background. Sociocultural sphere of communication: cultural and historical background. Socio-cultural sphere of communication: Cultural and historical background / Personal, private life. Sociocultural sphere of communication. Culture. Educational communicative sphere/World. Educational communication sphere. Student life. Sociocultural sphere of communication: Cultural and historical background. Education. Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty). Professional sphere of communication (the title of the topic depends on the specialty).</p>

Examination forms	Combined exam: listening, reading, speaking.
Study and examination requirements	Students are required to attend practical classes in a foreign language and take an active part in the implementation of INDEPENDENT WORK OF STUDENTS tasks, the results of which are accepted by the teacher online or in the classroom of the university, depending on the type and form of the task.
Technical and electronic learning tools	Presentation projector. Edpuzzle, Kahoot, Socrative, Edmodo.
Reading list	<ol style="list-style-type: none"> 1. Latham-Koenig. English File: Pre-Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 2. Latham-Koenig. English File: Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 3. Latham-Koenig. English File: Pre Intermediate Student's Book, 3d ed., Oxford University Press, 2016. 4. Reading Extra: A resource book of multi-level skills activities / Driscoll Liz. - 9th printing. - Cambridge [etc.]: Cambridge university press, 2017. 5. Speaking extra: a resource book of multi-level skills activities / Gammidge Mick. - 13th print. - Cambridge: Cambridge university press, 2017. 6. Listening Extra: A resource book of multi-level skills activities / Craven Miles. - 10th printing. - Cambridge [etc.]: Cambridge university press, 2016. 7. Writing extra: a resource book of multi-level skills activities / Palmer Graham. - 11th print. - Cambridge: Cambridge university press, 2016.

Module 3

Module code and name	KAZK 11104 Kazakh language
Semester(s) when the Module is taught	1/2
Lecturer	Kulmanov K.S.
Language of instruction	Kazakh
Connection with the curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours- 1 sem., (300 hours per year). Practical: 45 hours -1 sem., (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the Module	To master this module, you need the knowledge, skills and abilities acquired by the student in the course "Kazakh language" (A1, A2, B1).
Module objectives/intended learning outcomes	<p>To train students in listening (listening), speaking, reading and writing at level B2. Participate in communication in various situations in different areas of communication in order to realize their own intentions and needs (household, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation at level B2;</p> <p>To carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition based on knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions at level B2.</p>

Content of the Module	Introduction to the course. Kazakhstan on the way to independence: stages of formation of the idea of a national state. Civil-political confrontation. Implementation of the Soviet model of state building. Contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the twentieth century. Formation of the state structure of the Republic of Kazakhstan. Kazakhstani model of economic development. Social modernization is the basis for the well-being of society. Ethno-demographic processes and strengthening of interethnic harmony. Prospects for socio-political development and spiritual modernization. The policy of forming a new historical consciousness and worldview of the peoples of the Great Steppe. Kazakhstan is a state recognized by the modern world. Formation of a nation of a single future.
Examination forms	Combined exam: listening, reading, speaking..
Study and examination requirements	Interactive whiteboard, projector, electronic textbook, computer, assignments for practical exercises, specialty texts, additional handouts.
Technical and electronic learning tools	Presentation projector.
Reading list	1. Asanova U.O., Abduova B.S., Adilbek A.M., Magzumbekova A.K. Kazakh language. Study guide for level B1. Nur-Sultan: ENU, 2021. - 150 p. 2. Alimbek G.R. Kazakh language for Russian speakers (Tutorial for levels B1, B2). Nur-Sultan: "AIIDA baspasy PUBLISHING", 2021. -232 p. 3. Kulmanov K.S., Adilbek A.M., Magzumbekova A.K., Khamitova A.G. Kazakh language (Level A1. Textbook for foreign students). Nur-Sultan: ENU, 2021. - 176 p.

Module 4

Module code and name	RUSS 11104-11204 Russian language
Semester(s) when the Module is taught	1/2
Lecturer	Nurgazina A.B.
Language of instruction	Russian
Connection with the curriculum (cycle, component)	General educational (compulsory component)
Teaching methods	Group work. Problematic discussion. search method. Design. Essay. situational modeling. Text analysis. Creative writing.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours- 1 sem., (300 hours per year). Practical: 45 hours -1 sem., (90 hours per year), independent work of students: 105 hours (210 hours per year).
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the Module	To master this module, you need the knowledge, skills and abilities acquired by the student in the Russian language course (A1, A2, B1).
Module objectives/intended learning outcomes	To train students in listening (listening), speaking, reading and writing at level B2. Participate in communication in various situations in different areas of communication in order to realize their own intentions and needs (household, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation at level B2; To carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition based on knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions at level B2.
Content of the Module	Actual problems of modern science. New discoveries of scientists: prospects for use and possible risks. Scientific discoveries and ethics. Achievements in the field of the studied science. The development of science (studied by students). The current state of the studied science. My specialty and globalization. Written business communication. Business email correspondence. Oral business communication. Terminology of science. Specialty language. Written academic text. Culture of professional speech. Types of professional communicative situations.

Examination forms	Combined exam: listening, reading, speaking...
Study and examination requirements	Interactive whiteboard, projector, electronic textbook, computer, assignments for practical exercises, specialty texts, additional handouts.
Technical and electronic learning tools	Projector for presentation. Reference and information Internet portal - www.gramma.ru Reference and information Internet portal - www.dic.academic.ru Reference and information Internet portal - www.slovari.yandex.ru
Reading list	1. Russian language: textbook for university students of the Kazakh branch (bachelor's degree) / edited by K.K. Akhmedyarov, Sh.K. Zharkynbekov. – 4th edition. - Almaty: "Evero", 2019. - 241 p. 2. Zhuravleva E.A., Asmagambetova B.M., Tashimkhanova D.S., Yavorskaya E.E., Te M.V., Eshkeneva A.K. Professional Russian language: teaching aid. - Almaty: "Evero", 2021. - 242 p.

Module 5

Module code and name	CSSE 11005 Information and Communication Technologies
Semester(s) when the Module is taught	2
Lecturer	Karymsakova A.E.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (required component)
Teaching methods	Interactive, project method, case study, student-centered learning
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5 ECTS
Required and recommended prerequisites for joining the Module	Informatics

Module objectives/intended learning outcomes	<p>The purpose of using ICT multimedia in the educational process is determined by the possibility of implementing intensive forms and methods of teaching, strengthening the motivational component of learning through the use of modern means of processing audiovisual information, increasing the level of emotionality of its perception, and developing skills to implement various forms of independent information processing activities.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> – to explain the purpose, content and development trends of information and communication technologies, to justify the choice of the most appropriate technology for solving specific problems; to know the features of the use of multimedia on the Internet; – to explain methods of collecting, storing and processing information, ways of implementing information and communication processes; to develop multimedia content; – to describe the architecture of computer systems and networks, the purpose and functions of the main components; – to use information Internet resources, cloud and mobile services to search, store, process and disseminate information; – to apply software and hardware of computer systems and networks for collecting, transmitting, processing and storing data; – to analyze and justify the choice of methods and means of information protection; – using digital technologies to develop analysis and data management tools for various types of activities; – to carry out project activities in the specialty using modern information and communication technologies. <p>Competencies:</p> <ul style="list-style-type: none"> – mastering by students of the conceptual foundations of the architecture of computer systems, operating systems and networks; evaluate the effectiveness of digitalization in professional areas; – formation of knowledge about the concepts of developing network and web applications, information security tools; <p>developing skills in the use of modern information and communication technologies in various areas of professional activity, scientific and practical work, for self-education and other purposes.</p>
Content of the Module	<p>The role of ICT in key sectors of the development of society. ICT standards. Introduction to computer systems. Architecture of computer systems. Software. Operating Systems. Human-computer interaction. Database systems. Data analysis. Data management. Networks and telecommunications. Cybersecurity. Internet technologies. Cloud and mobile technologies. multimedia technologies. Smart technologies. Electronic technologies. Electronic business. E-learning. Electronic government. Information technologies in the professional sphere. Industrial ICT. Prospects for the development of ICT.</p>
Examination forms	Computer testing
Study and examination requirements	Mandatory attendance of online and classroom classes, active participation in the discussion of issues, preliminary preparation for lectures and practical exercises, high-quality and timely completion of tasks of the SRO, participation in all types of con
Technical and electronic learning tools	Personal computer, interactive whiteboard
Reading list	<ol style="list-style-type: none"> 1. Brown G., Sargent B., and Watson D. Cambridge IGCSE ICT. - London: Hodder Education Group, 2015. -439 p. 2. Williams B. K. and Sawyer S. Using information technology: A practical introduction to computers & communications. - New York: McGraw-Hil., - 8th ed. -2010. -563 p. 3. Watson D. and Williams H. Cambridge IGCSE Computer Science: Hodder Edu.; 3 ed. 2015.-278 p. 4. Evans V. Information technology. Books 1-3: English for specific purposes.- 5th impr.- Newbury: Express Publishing, 2014.- 40 p.

Module 6

Module code and name	PhCS 14114-14215 Physical Training
Semester(s) when the Module is taught	1/2/3/4
Lecturer	Marchybayeva U.S., Nazarkina O.N.
Language of instruction	Kazakh/Russian

Connection with the curriculum (cycle, component)	General educational (required component)
Teaching methods	Exercises
Workload (incl. contact hours, self-study hours)	General workload: 60 hours- 1,2,3,4 sem. (240 hours per year). Practical: 60 hours -1,2,3,4 sem. (240 hours per year),
Credit points (total by discipline)	In the semester - 2. Total - 8 ECTS
Required and recommended prerequisites for joining the Module	To master the course of physical culture, knowledge, skills and abilities acquired in the study of the following disciplines are necessary: anatomy, pedagogy, biology.
Module objectives/intended learning outcomes	Formation of competencies in physical culture, aimed at developing the student's personality and the ability to use the means and methods of physical culture and sports for the preservation and promotion of health, psychophysical training and self-preparation for future life and professional activities. Willingness to apply methods, means, fundamentals of the theory and methodology of physical culture and sports to ensure a full-fledged social and professional activity. - formation of a healthy lifestyle and lifestyle; - independently select and apply methods and means of physical culture for the formation and improvement of basic physical qualities and motor skills; -correctly perform physical exercises, calculate the dosage of the exercise and make up sets of exercises for the development of basic physical qualities. -preparation for professional activity and service in the Armed Forces of the Republic of Kazakhstan;
Content of the Module	The discipline "Physical culture" is the most important component of the integral development of the personality. Being an integral part of the general culture and professional training of a student throughout the entire period of study, physical culture is an obligatory section in all components of education, the significance of which is manifested through the harmonization of spiritual and physical forces, the formation of such universal values as health, physical and mental well-being, physical perfection . It ensures the continuity of the educational process with the programs of physical education of students in schools and secondary specialized educational institutions.
Examination forms	Differentiated offset
Study and examination requirements	Students who have not attended all the practical classes are not allowed to take a differentiated test. Repetitions of the topic and working out of the materials covered for each training session are required. The degree of mastering the educational practical material is checked by testing the physical fitness of students. Students may be tested without warning.
Technical and electronic learning tools	Sports simulators, sports equipment, TV and video equipment
Reading list	1. Moiseeva N.A. Gymnastics with teaching methods: textbook / N.A. Moiseev. - Almaty: New book, 2020. - 152, [1] p. : ill., tab. - Bibliography: p. 147. 2. Borodikhin V.A. Health-saving orientation of physical education and sports of schoolchildren and students: [monograph] / V.A. Borodikhin, Zh.A. Usin, Zh.A. Usin. - Almaty: SSK, 2019. - 302 p. 3. Theory and methods of teaching basic sports. Athletics: a textbook for educational institutions of higher professional education, in the direction of training "Physical Culture" / G.V. Gretsov, S.E. Voinova, A.A. Germanova and others; edited by G.V. Gretsov and A.B. Yankovsky. - 3rd ed., Rev. - Moscow: Academy, 2016. - 287 p. 4. Marchibaeva U.S. Methodical foundations of physical culture: electronic textbook / Mubarakkyzy B.M., Tashkeev D.S., Kulanova K.K., Sidorova R.V. Astana: ENU named after L.N. Gumilyov, 2015. Certificate of state registration of rights to the object of copyright. IS 002796

Module 7

Module code and name	PHIL 21002 Philosophy
Semester(s) when the Module is taught	3

Lecturer	Tolgambayeva D.T.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (required component)
Teaching methods	Flipped class, problem lecture, case studies, brainstorming, game methods
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	History of Kazakhstan, Culturology
Module objectives/intended learning outcomes	<p>The purpose of the course is to form students' holistic systemic understanding of philosophy as a special form of knowledge of the world, its main sections, problems and methods of studying them in the context of future professional activities.</p> <ul style="list-style-type: none"> - Know the meaning of the main philosophical concepts and categories, the content of the main philosophical concepts regarding fundamental philosophical problems, the patterns of development of nature, society and thinking; - Be able to apply the conceptual and categorical apparatus, the basic laws of the humanities and social sciences in professional activities; apply methods and means of cognition for intellectual development, raising the cultural level, professional competence; analyze the processes and phenomena occurring in society; interpret philosophical texts (primary sources and commentary literature), as well as express their interpretation both in writing and orally; - Have the skills of philosophical thinking to develop a systematic, holistic view of the problems of society; competently express and argue their point of view (orally and in writing) when borrowing and interpreting one or another of the learned ideas and concepts, the ability to trace the relationship between various traditions and trends.
Content of the Module	The emergence of a culture of thinking. The subject and method of philosophy. Fundamentals of philosophical understanding of the world. Consciousness, soul and language. Being. Ontology and metaphysics. Knowledge and creativity. Education, science, engineering and technology. Man and the Universe. World of things. Life and death. Meaning of life. Ethics. Philosophy of values. Axiology and morality. Philosophy of freedom. The concept of freedom in the history of philosophy. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. “Mangilik el” and “Rukhani zhangyru” are the philosophy of the new Kazakhstan.
Examination forms	Computer testing
Study and examination requirements	Class attendance and active participation in the learning process are mandatory. High-quality and timely fulfillment of the tasks of the SRO, actively participate in the oral survey conducted by the teacher during classes, written express control. The preparation by the student of messages (reports) on certain issues of the topic being studied, participation in a free discussion organized by the teacher in order to consolidate and deepen the knowledge gained in lectures and in the process of independent work also contributes to a significant increase in the level of knowledge. For a quality mastering of the course, the student should be guided by the fact that he independently works with texts, approximately 40-60 pages per week. To successfully pass the final control, the student will have to pass test tasks in Platonus in the amount of 40 questions.
Technical and electronic learning tools	Computer, projector, and applications: mook.enu.kz, moodle.enu.kz

Reading list	<ol style="list-style-type: none"> 1. Abdildin Zh.M., Abdildin R.Zh. History of philosophy. - Almaty, Asem-System, - 2010. - 258 p. 2. Hess R. Philosophynyn tandauli 25 kitabs. /gylym ed. Raev D.S. - Astana, 2018. -360 p. 3. Yesim, G.. Human metaphysics.- Almaty, 2012 4. Mironov V.V. Philosophy. Textbook. – M.: Prospekt, 2016. – 289 p. 5. Masalimova A.R., Altaev Zh.A., Kasabek A.K. Kazakh Philosophy. Tutorial. – Almaty, 2018 6. Johnston D. Brief history of philosophy / per. HER. Sukharev. -M.: Astrel, 2010. - 236 p. 7. Yesim, G.. Khakim Abay. - Astana, 2012 5. Yesim, G.. Wisdom of Shakarim.- Almaty, 2008
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Module 8

Module code and name	EDUC 22001 Social and Political Knowledge Module
Semester(s) when the Module is taught	1
Lecturer	Burbayeva P.T
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (required component)
Teaching methods	Flipped class, problem lecture, case studies, brainstorming, game methods
Workload (incl. contact hours, self-study hours)	General workload: 240 hours. Lectures: 30 hours, practical: 60 hours, independent work of students: 150 hours
Credit points (total by discipline)	8
Required and recommended prerequisites for joining the Module	History of Kazakhstan, Culturology
Module objectives/intended learning outcomes	<p>The purpose of studying the course: the formation of the socio-humanitarian outlook of students in the context of solving the problems of modernizing public consciousness, defined by the state program "Looking into the Future: Modernizing Public Consciousness".</p> <p>Expected learning outcomes based on the results of mastering the course:</p> <ul style="list-style-type: none"> - to explain and interpret the subject knowledge (concepts, ideas, theories) of sociology that make up the training courses of the module; - explain the socio-ethical values of society as a product of integration processes in the systems of basic knowledge of the courses of the socio-political module; - algorithmically represent the use of scientific methods and research techniques in the context of specific training courses and in the procedures for interacting module courses; - to explain the nature of situations in various areas of social communication based on the content of theories and ideas of the scientific areas of the courses being studied; - reasonably and reasonably provide information about the various stages of development of Kazakhstani society, public and interpersonal relations; - to analyze the features of a social institution in the context of their role in the modernization of Kazakhstani society.
Content of the Module	<p>Subject and object of science. Introduction to the theory of sociology. sociological theory. The development of individual schools and trends (O. Comte, G. Spencer, E. Durkheim, M. Weber, K. Marx). Social structure and stratification of society. Society, equality and inequality. Open and closed society. Stratification as a structured inequality between different groups. Systems of stratification and differentiation. Brief review of theories of social stratification (K. Marx, M. Weber). Forms of social stratification (P. Sorokin). social mobility. Horizontal and vertical mobility. Socialization and identity. Relations between the individual and society. Theories of socialization and identity. (T. Parsons, G. H. Mead). Stages of socialization. primary socialization. Average socialization. Adult stage of socialization. Gender socialization. Gender order. Identity and personality. Social and personal identity. Roles and statuses. Sociological research. Sociological research design. Explore the issue. Hypotheses. Variables. Sample. Information collection methods. Qualitative and quantitative. Data analysis.</p>

Examination forms	Computer testing.
Study and examination requirements	Students are required to attend Lectures and seminars, prepare in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, and fulfillment of teacher assignments. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical and electronic learning tools	PowerPoint, MindMeister, Miro.com, XMind, Lucidchart, Canva
Reading list	<ol style="list-style-type: none"> 1. Biekenov K.U., Biekenova S.K., Kenzhakimova G.A. "Sociology: Uch. allowance". - Almaty: Evero, 2016. - 584 p. 2. Abdiraimova G.S. Zhastar Sociologies: Eyes of the Curals. 2-basylym. - Almaty: "Kazakh University", 2012. - 224 p. 3. Brinkerhof D., Veits R., Ortega S. Aleumettanu Negizderi. - Almaty: Ultik Audima Bureau, 2018. . – 584 p. 4. J. Ritzer, J. Stepnicki Aleumettanu teorisi.- Almaty: Ultik audarma bureaus, 2018. 5. Aitov N.K. Aleumettanu. Astana, 2015 6. Smagambet B.Zh. Sheteldik aleumettanu tarihy. – Almaty: Evero, 2016.

Module 9

Module code and name	ECON 22001 Entrepreneurship and business
Semester(s) when the Module is taught	4
Lecturer	Ryspekova M.O.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (component of your choice)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	Recommended prerequisites: knowledge of the basics of economics in the framework of the secondary school program "Economics and Entrepreneurship"».
Module objectives/intended learning outcomes	<p>“Entrepreneurship and business” is the acquisition of the necessary entrepreneurial skills, understanding the mechanism of the functioning of the market structure in business.</p> <p>Knowledge: familiarity with the theory of business and entrepreneurship, systematization of regulatory, economic, organizational and managerial knowledge on the formation, conduct of entrepreneurship and business. Skills: cognitive and practical skills to develop an entrepreneurial mindset to solve specific problems and business situations. Skills in preparing, evaluating and implementing business development projects in various sectors of the economy; skills of organizing, reorganizing and liquidating business firms and preparing working documentation - tools for regulating economic relations between business entities. Competences: to form the readiness of students for entrepreneurial activity and for organizing their own business. Skills in preparing, evaluating and implementing business development projects in various sectors of the economy. Collect, analyze and process the data necessary to solve the set economic tasks in the field of business organization and development; Select and apply economic data processing tools in the field of business organization and management in accordance with the task, analyze the results of economic efficiency calculations and substantiate the conclusions.</p>

Content of the Module	Introduction to Entrepreneurship and Business. Essence of business and entrepreneurship. Goals, functions and general characteristics of the business. Modern business system: subjects of business relations, business infrastructure, government support. Business forms. Small, medium and large businesses. Registration of a business company. Organization of a business firm. Reorganization and termination of the company. Economic activity in the business system. Business competition. Business activity and contracts of the firm. Tax system in business. Business interests in business. Entrepreneurial risk. Innovative entrepreneurship. Business infrastructure.
Examination forms	Oral exam.
Study and examination requirements	Organization of the lesson using active forms and methods of the educational process, mandatory control. The exam serves as a form of checking the educational achievements of students throughout the professional curriculum of the discipline and provides for the development of educational achievements of students for the academic period, the theoretical knowledge gained, the strength of their assimilation, creative thinking, and independent work skills.
Technical and electronic learning tools	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	<ol style="list-style-type: none"> 1. Esirkepova A.M. Modern entrepreneurship: textbook / A.M. Esirkepova. - Almaty: New book, 2020. - 304 p. 2. Baigelova A.N. Fundamentals of entrepreneurship: textbook / A.N. Baigelova, Zh.E. Sadykova, T.M. Nasymkhan. - Almaty: Lantar Trade, 2019. - 292 p. 3. Ryspekova M.O. Fundamentals of entrepreneurship: a study guide. - Almaty: Epigraph, 2019. - 231 p. 4. Maidyrova A.B. Entrepreneurship and business: cases, business games, tasks and schemes: study guide /A.B. Maidyrova, R.A. Baizholov. - Nur-Sultan: ENU them. L.N. Gumilyov, 2020. - 172 p. 5. Maidyrova A.B. Economics of small and medium business: study guide /A.B. Maidyrova, M.O. Ryspekov. - Nur-Sultan: ENU them. L.N. Gumilyov, 2019. -251 p.

Module 10

Module code and name	CSSE 22002 Digital technologies by branches of application
Semester(s) when the Module is taught	4
Lecturer	Mukhtarova A.Zh.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (component of your choice)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	Information and Communication Technologies

Module objectives/intended learning outcomes	<p>Purpose: to introduce students to the prospects and examples of using digital technologies to improve the efficiency and quality of their activities.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - to study the basic concepts of digital technologies, platforms and mobile devices; - know the features of using multimedia on the Internet; - be able to effectively use digital technologies and Internet resources; - develop multimedia content; - use the functionality of social networks; - use various means of processing and storing digital information; - analyze the reliability of means and methods of protection in the network; <p>Competencies:</p> <ul style="list-style-type: none"> - the formation of students' skills and abilities necessary for their further professional activities; - evaluate the effectiveness of digitalization in professional areas. - to synthesize the effective use of Internet services for work and life.
Content of the Module	<p>Introduction to the course. State program "Digital Kazakhstan". Smart city. Basic concepts. Platforms and technologies of the organization. Roadmap of smart Astana. Computer networks. Internet. Internet access technologies. Internet by wire. Internet without wires. Mobile Internet. Mobile networks (3G, 4G/LTE). Cellular systems. Digital platforms for electronic public services. Electronic digital signatures (EDS). Information system "Electronic licensing". Digital e-commerce platforms. Electronic commerce. Virtual payment means and systems. Internet shops. Online shopping. Information security on the Internet. Cybersecurity. Strong passwords. two-step authentication. 3D modeling and animation. 3D graphics. 3D modeling. Virtual and augmented reality VR and AR. Introduction to Java. Java programming language. Introduction to the Python programming language. Processing of digital information in the professional field. Organization of texts, transformation of textual information. Processing of graphic images. Compression of digital information. Database. Big data and open data. Statistical processing of results using the program STATISTICA. Modern multimedia services. Social networks. Search engines. Electronic catalogs, libraries. Videoconferencing. The use of cloud technologies for storing digital information. General concepts of cloud technologies. Advantages and disadvantages of cloud services.</p>
Examination forms	Computer testing.
Study and examination requirements	<p>The course "Digital Technologies by Industry" is an optional component. The work must be completed within the specified time frame. Students who do not complete all tasks are not allowed to take the exam. Refinement of the topic and development of the materials covered for each training session are required. The degree of assimilation of educational material is checked by testing. Students may be tested without warning.</p>
Technical and electronic learning tools	Programs Python, Java, STATISTICA.
Reading list	<ol style="list-style-type: none"> 1. Brown G., Sargent B., and Watson D. Cambridge IGCSE ICT. - London: Hodder Education Group, 2015. -439 p. 2. Williams B. K. and Sawyer S. Using information technology: A practical introduction to computers & communications. - New York: McGraw-Hil., - 8th ed. -2010. -563 p. 3. Watson D. and Williams H. Cambridge IGCSE Computer Science: Hodder Edu.; 3 ed. 2015.-278 p. 4. Evans V. Information technology. Books 1-3: English for specific purposes.- 5th impr.- Newbury: Express Publishing, 2014.- 40 p.

Module 11

Module code and name	CULS 22005 Rukhani Zhangyru
Semester(s) when the Module is taught	4
Lecturer	Battalov K.K.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (component of your choice)

Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	Modern history of Kazakhstan
Module objectives/intended learning outcomes	The course covers topical issues of modernization of modern Kazakh society. The course is aimed at forming an idea of modern world trends in the post-industrial development of society, a vision of one's own and the world's future, an understanding of the development trend of the world labor market, an idea of Kazakhstan's identity, and the main directions for the development of the country's spiritual modernization. The course covers the basic knowledge of leadership strategies in society. World examples of leadership in different historical periods are considered
Content of the Module	The educational program is based on three conceptual foundations: cognitive - the study of the foundations of the modernization of public consciousness and the patterns of development of modern society; patriotic - respect for history, the heroic past of their people, love for the Fatherland, native land, historical figures, involvement in national values; informational - popularization of spiritual and moral values that strengthen national self-consciousness, clarification of the tasks defined in the Program Article of the Head of State, strategic documents of the country, the Message of the President to the people of Kazakhstan. The discipline consists of 3 modules: 1. Modernization in the context of globalization. The world of the future. 2. Modernization of consciousness as a factor in the success of the nation. 3. Leadership in the conditions of modernization.
Examination forms	Oral exam.
Study and examination requirements	The activity of students in the educational process is obligatory, which is assessed by the quality of their implementation. Attendance at classes and participation in the educational process are mandatory. Students should not miss classes without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical and electronic learning tools	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	1. Nazarbaev N.A. A look into the future: modernization of public consciousness // Kazakhstanskaya Pravda, 2017. - 12 sauir. 2. Nazarbayev N. The era of independence. - Astana, 2017. - 508 p. 3. Yuval Noah Harrari. "Homo Deus: A Brief History of the Future". - M.: Sinbad, 2018. - 496 p. 4. Kuttykadam S. "10 examples of serving the nation." - Almaty: INES-TSA, 2009. 356p. 5. Abai Kunanbaev. Selected ("Wisdom of the Ages" series), Muskeu, 2006 6. Nazarbaev N. On the wave of history. - Almaty: "Atamura", 1999 7. Terminasova, S.G. Language and intercultural communication. - Almaty; Astana, 2018.

Module 12

Module code and name	COMU 22003 Business rhetoric
Semester(s) when the Module is taught	4
Lecturer	Shakhin A.A., Tachimkhanova D.S.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (component of your choice)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases..

Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	Kazakh/Russian language
Module objectives/intended learning outcomes	The goal is to develop the skills of effective public speaking, the skills of successful communication in various situations of business communication. Know the main rhetorical strategies and tactics, methods of argumentation aimed at achieving a communicatively meaningful result. To be able to apply knowledge of oratorics to the speech facts of business communication; build effective business communication in accordance with the students' own communicative intentions. Possess the skills of effective interaction with participants in the process of business communication in various genres of business communication.
Content of the Module	The course has a professional and practical focus. Its study involves mastering the technology of rhetorical activity in professionally significant situations. The objectives of the course include improving the speech education of students, gaining knowledge about the principles of effective business communication, the main factors and processes that ensure the successful impact of public speaking on listeners, forms and means of interaction between the speaker and the audience. The student gains knowledge about the main rhetorical strategies and tactics aimed at achieving a communicatively meaningful result; fundamentals of public speaking skills; knowledge of the terminological apparatus of the course; the ability to produce tests of an official business orientation, to be aware of one's own communicative intentions and to build effective business communication in accordance with this.
Examination forms	Combined exam
Study and examination requirements	The activity of students in the educational process is obligatory, which is assessed by the quality of their implementation. Attendance at classes and participation in the educational process are mandatory. Students should not miss classes without a valid reason. Late arrivals are not allowed. The code of conduct and ethics must comply with the requirements of the university. In this regard, marks are given from 0 to 100 points.
Technical and electronic learning tools	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	1. Sternin I.A. Practical rhetoric: textbook. allowance for students of higher educational institutions. - M.: "Academy", 2016. - 272 p. 2. Shelamova G.N. Etiquette of business communication: textbook. allowance for the beginning prof. education. - M.: "Academy", 2015. - 192 p. 3. Vvedenskaya L.A. Business rhetoric: Textbook for universities. - Rostov n / a, 2012. 4. Malkhanova I.A. Business communication: textbook. allowance. - M.: Academic project, 2014. - 224 p. 5. Anisimova T.V., Gimpelson E.G. Modern business rhetoric: study guide. - M.: NPO "MODEK", 2017. - 432 p. 6. Golub I.B. Rhetoric: textbook. allowance. - M.: "Eksmo", 2015. - 384 p. Kuzin F. A. Culture of business communication. - M., 2017.

Module 13

Module code and name	ECLFST 22004 Fundamentals of ecology and life safety
Semester(s) when the Module is taught	4
Lecturer	Kobetaeva N.K.
Language of instruction	Kazakh/Russian
Connection with the curriculum (cycle, component)	General educational (component of your choice)

Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	School biology course
Module objectives/intended learning outcomes	<p>Formation of an ecological outlook, obtaining deep systemic knowledge and ideas about the basics of ecology and life safety, theoretical and practical knowledge about modern approaches to the rational use of natural resources and environmental protection.</p> <p>As a result of studying this discipline, students should know:</p> <ul style="list-style-type: none"> - the main patterns of interaction between nature and society; - fundamentals of functioning of ecosystems and development of the biosphere; - impact of harmful and dangerous production factors and environment on human health; - concept, strategies, problems of sustainable development and practical approaches to their solution at the global, regional and local levels; - Fundamentals of environmental legislation; - principles of organization of safe production processes; <p>be capable of:</p> <ul style="list-style-type: none"> - assess the ecological state of the natural environment; - to assess the technogenic impact of production; <p>the environment have the skills to:</p> <ul style="list-style-type: none"> - study of the components of ecosystems and the biosphere as a whole; - determination of optimal conditions for sustainable development of ecological and economic systems; - conducting a logical discussion of topics related to the solution of environmental problems; - knowledge of standard environmental monitoring methods
Content of the Module	Ecology and problems of modern civilization. Autoecology is the ecology of organisms. Demecology is the ecology of populations. Synecology-Ecology of the Community. Biosphere and its sustainability. Evolution of the biosphere. The concept of living matter. modern biosphere. Global biogeochemical cycles. Ecological crisis and problems of modern civilization. Strategies, goals and principles of safety and life. Green economy and sustainable development. Natural resource management. Ecoenergy. Global energy-ecological strategy for sustainable development XXI century. Water is a strategic resource of the 21st century. Renewable energy sources. Ecological policy of the Republic of Kazakhstan. The concept of sustainable development of the Republic of Kazakhstan. Atmospheric protection. Protection of water resources. Protection of land resources, soils and subsoil. Physical pollution of the environment. Protection of flora and fauna.
Examination forms	Computer testing
Study and examination requirements	Students are required to attend Lectures and seminars, prepare in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, and fulfillment of teacher assignments. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical and electronic learning tools	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).

Reading list	<p>1 Akimova T. A., Khaskin V. V. Ecology. Man-economy-biota-environment: A textbook for university students / 2nd ed., reprint. and appendix-M: UNITY, 2009. - 556 p.</p> <p>2 Bigaliev A.B. General ecology / Second edition, revised. added. - Almaty: NUPRESS Publishing House, 2011.</p> <p>3 Denisova V. V. Ecology: Textbook - M., 2004.</p> <p>4 Abubakirova K. D., Kozhagulov S. O. Ecology and sustainable development. - Almaty, 2011</p> <p>5 Kolumbaeva S.Zh. and others. Ecology and sustainable development. - Almaty, "Kazakh University", 2011</p> <p>6 Alimov M.Sh. Ecology and sustainable development. - Almaty, 2012</p> <p>7 Korobkin V. I., Peredel'sky L. V. Ecology: Textbook for university students. - Rostov n / a: Phoenix, 2007-575 p.</p> <p>8 Tonkopyiy M.S., Satbaev G.S., Imkulova N.P., Anisimova N.M. Almaty: ZhSS RPBC "Daur", 2011-312 b.</p> <p>9 Kolumbaeva S.Zh. Zhalpy ecology. - Almaty: 2006</p>
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Module 14

Module code and name	LAWS 22007 Anti-corruption culture
Semester(s) when the Module is taught	4
Lecturer	Ibragimov Zh. I., Temirzhanova L.A.
Connection with the curriculum (cycle, component)	General educational (component of your choice)
Teaching methods	Review, information, problematic lectures in the form of presentations, the method of conducting - lectures are combined into three main elements: presentation of new material, posing problem questions, joint search for answers, solving problem cases.
Workload (incl. contact hours, self-study hours)	General workload: 150 hours. Lectures: 30 hours, practical: 15 hours, independent work of students: 105 hours
Credit points (total by discipline)	5
Required and recommended prerequisites for joining the Module	School course "Man, society and law".
Module objectives/intended learning outcomes	<p>The purpose of the anti-corruption culture is the education of values and the development of abilities necessary for the formation of a civil position in young people in relation to corruption, the formation of a negative attitude towards corruption manifestations.</p> <p>Learning outcomes:</p> <p>Students will gain knowledge about the essence of corruption and the causes of its occurrence. Students will be able to analyze the measure of moral, ethical and legal responsibility for corruption offenses. Students will be familiar with the anti-corruption policy of the state and the current anti-corruption legislation. Students will be able to realize the values of moral consciousness and follow moral standards in daily practice. Students will be able to determine the legal course of action in a situation of conflict of interest.</p>
Content of the Module	The Fundamentals of Anti-Corruption Culture course aims to raise awareness of corruption and shape its image as a public policy issue. The purpose of studying the course is to form a system of knowledge on combating corruption, the existing legal responsibility and the development on this basis of a civil position in relation to this phenomenon. Development of a legal culture of an individual that contributes to the fight against corruption, the formation of skills and abilities for a critical analysis of corruption phenomena, the study of modern anti-corruption approaches and practices.
Examination forms	Computer testing

Study and examination requirements	Students are required to attend Lectures and seminars, prepare in advance for lectures and seminars on the basis of textbooks and basic literature, participate in all types of control (current control, midterm control, final control), mandatory participation in intermediate and final certification tests, and fulfillment of teacher assignments. The activity of work at the seminar (the ability to lead a discussion, to argue one's position with references to the literature studied, a creative approach to the selection and analysis of texts), the quality of individual written assignments (glossary, etc.) and creative work (essays) are highly valued.
Technical and electronic learning tools	Types of technical means: computers, interactive whiteboards, projectors. Teaching methods using visualization (presentation).
Reading list	<p>Main links:</p> <ol style="list-style-type: none"> 1. Fundamentals of anti-corruption culture: textbook. Under. ed. B.S. Abdrasilov. - Astana: Academy of Public Administration under the President of the Republic of Kazakhstan, 2016. - 176 p. 2. Anti-corruption. Textbook and practice. Under the general editorship of E.V. Okhotsky. - Moscow, 2016. - 146 p. 3. Anti-corruption: constitutional and legal approaches. Collective monograph / otv. Avakyan S.A. – M.: Yustitsinform, 2016. – 512 p. 4. Rose-Akkeman S. Corruption and the state. Causes, effects, reforms. M.: Logos, 2010. 5. Anti-corruption legal policy: textbook. Allowance / E. Alaukhanov. - Almaty: Zan adebieti, 2009. - 256 p. 5. Morality as the basis for the formation of a new generation of civil servants. / Kabykenova B.S., Shakhanov E.A., Dzhusupova R.S. - 2011. 6. Bureaucracy, corruption and efficiency of public administration / VD Andrianov. - M.: Wolters Kluwer, 2009. - 248 p. - Bibliography: 234 p. 7. Corruption and the state: Causes, consequences, reforms: Per. from English. O.A.Alyakrinsky / S. Rose-Ackerman. – M.: Logos, 2003. – 356 p. 8. Power, corruption and honesty: Nauch. ed.: Per. from English. / A. A. Rogov. - M.: Publishing House of the RAGS, 2005. - 176 p.

Module 15

Module code and name	MATH22003 Mathematical analysis I								
Semester(s) when the Module is taught	2								
Lecturer	1. Musabayeva G.K. 2. Taugynbayeva G.E.								
Credit points (total by discipline)	8 ECTS								
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling								
Workload (incl. contact hours, self-study hours)	<p>Total workload: 240</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Lectures</th> <th style="width: 33%;">Practical training</th> <th style="width: 33%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">45</td> <td style="text-align: center;">30</td> <td style="text-align: center;">165</td> </tr> </tbody> </table>			Lectures	Practical training	Self-study hours	45	30	165
Lectures	Practical training	Self-study hours							
45	30	165							
Required and recommended prerequisites for joining the Module	School mathematics Module								
Module objectives/intended learning outcomes	Own the theoretical provisions of all sections of the "Mathematical Analysis-1" module, methods for finding the limits of sequences and functions, differentiation of functions to study the behavior of functions and construct a sketch of a graph of functions. Be able to apply the acquired knowledge in solving problems of economic and engineering content.								

Content of the Module	Set, operations on sets, function, types of functions. Number sets, upper and lower bounds of number sets, bounded sets, largest and smallest elements of number sets, number gaps. Axioms of the set of real numbers and their consequences, supremum and infimum of number sets. Arithmetic roots, a theorem on the existence and uniqueness of an arithmetic root. Logarithm, logarithm existence theorem. Sequence, sequence limit. Converging sequences and their properties. Existence of a limit of a monotone sequence. Subsequences and partial limits, Bolzano-Weierstrass theorem, Cauchy criterion. Function limit. Continuity of a function at a point. breakpoints. Bolzano-Cauchy theorem, Weierstrass, continuity uniformity, Cantor's theorem. Derivative. Higher derivatives. Theorem of Fermat, Rolle, Cauchy, Lagrange, Darboux. Differential. L'Hopital's rule. Taylor formula. Sufficient conditions for a local extremum, finding the largest and smallest values of functions, convex functions, inflection points, sketching a function graph.
Examination forms	Composite exam
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	Temirgaliev N. Mathematical analysis. Vol. I. -Almaty: Mektep, 1987, 288 pages (in Kazakh) Temirgaliev N. Mathematical analysis (revised and supplemented second edition). -Nur-Sultan: L.N. Gumilyov Eurasian National University, 2022. - 2000 pages (in Kazakh) Nikolsky S.M. Module of mathematical analysis. Vol. I, II. - 3-ed.- M.: Nauka, 1983 (in Russian)

Module 16

Module code and name	MATH22004 Mathematical analysis II		
Semester(s) when the Module is taught	3		
Lecturer	1. Musabayeva G.K. 2. Taugynbayeva G.E.		
Credit points (total by discipline)	8 ECTS		
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling		
Workload (incl. contact hours, self-study hours)	Total workload: 240		
	Lectures	Practical training	Self-study hours
	45	30	165

Required and recommended prerequisites for joining the Module	Mathematical Analysis I
Module objectives/intended learning outcomes	Own the theoretical provisions of all sections of the "Mathematical Analysis-2" module, methods for calculating indefinite integrals, Riemann integrals for finding the areas of plane figures, the length of an arc of a plane curve, the volumes of bodies of revolution, the surface areas of rotation, moments and centers of gravity of plane figures and other problems of geometric and physical content, methods for finding the limits of sequences and functions in the space R^n , differentiation of functions of many variables for the study of functions to an extremum. Be able to apply the acquired knowledge to solve problems of geometry and physics.
Content of the Module	primitive function. Indefinite integral, general methods of integration. Riemann integrability criterion for a function. Properties of the Riemann integral. Newton-Leibniz formula. Application of the Riemann integral. Multidimensional Euclidean space. Sequence in R^n and its limit. Numerical function of several variables and its limit in languages of neighborhoods and sequences and their equivalence. Continuity of a function of several variables at a point and on a set. Uniform continuity, Cantor's theorem. Functions from R^n to R^m and its limit, its connection with the limit of a function from R^n to R^1 . Continuity of a function from R^n to R^m . The Bolzano-Cauchy theorem in the case of numerical functions of several variables. Repeat limits. Determination of differentiability of functions of several variables at a point. Differential and partial derivatives, partial derivatives of higher orders. Directional derivatives, gradient. Taylor formula and local Taylor formula for the case of a function of several variables. Definition and necessary condition for a local extremum of functions of several variables. Sufficient extremum condition (general case). Sylvester's criterion. Finding the largest and smallest values of a function continuous on a compact and continuously differentiable inside a compact. Implicit functions (Definition (two-dimensional and general cases), existence and continuity, differentiability). Extremes under the condition (conditional extreme).
Examination forms	Oral
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	Temirgaliev N. Mathematical analysis. Vol. I. -Almaty: Mektep, 1987, 288 pages (in Kazakh) Temirgaliev N. Mathematical analysis (revised and supplemented second edition). -Nur-Sultan: L.N. Gumilyov Eurasian National University, 2022. - 2000 pages (in Kazakh) Nikolsky S.M. Module of mathematical analysis. Vol. I, II. - 3-ed.- M.: Nauka, 1983 (in Russian)

Module 17

Module code and name	MATH22008 Mathematical analysis III		
Semester(s) when the Module is taught	4		
Lecturer	1. Musabayeva G.K. 2. Taugynbayeva G.E.		
Credit points (total by discipline)	8 ECTS		
Teaching methods	Lectures, practices, laboratory work, seminars, projects		
Workload (incl. contact hours, self-study hours)	Total workload: 240		
	Lectures	Practical training	Self-study hours
	45	30	165
Required and recommended prerequisites for joining the Module	Mathematical Analysis II		
Module objectives/intended learning outcomes	Own the theoretical foundations of the integral calculus of functions of many variables, improper integrals, integrals depending on a parameter and Fourier series. Be able to apply the acquired knowledge in solving problems of theoretical and applied significance.		
Content of the Module	<p>Numerical series and its convergence, criterion for the convergence of a series with non-negative members, signs of convergence of numerical series. Numerical series with members of an arbitrary sign. The product of rows. Row permutations. Pointwise convergence of functional sequences and series. Definition of uniform convergence, Cauchy criterion for uniform convergence, Weierstrass test for uniform convergence of a functional series. Dirichlet and Abel criteria for uniform convergence of a functional series. Uniform convergence and continuity, integration, differentiation. Power series, Abel's theorem on the continuity of the sum of a power series at the boundary point of the convergence interval. Taylor rows. Improper integrals. Eigenintegral depending on the parameter, improper integral depending on the parameter. Double and multiple Riemann integrals. Definition of the Riemann integral over a Jordan measurable set. Change of variable in the double integral. Sets of Jordan and Lebesgue measure zero and their properties. Curves, curvilinear integral of the first kind as a generalization of the one-dimensional Riemann integral (definition, sufficient existence conditions), curvilinear integral of the second kind along a continuously differentiable curve, generalization of a curvilinear integral to the case of a piecewise continuously differentiable curve, Orientation of a flat region, Green's formula. Surface integral of the first kind, surface integral of the second kind. Gauss-Ostrogradsky formula, Stokes formula. Scalar and vector fields as a mathematical equivalent of mechanical, physical scalar and vector quantities. Improper multiple Riemann integrals. Fourier series in orthogonal and trigonometric systems. Fourier transform, Fourier integral, applications.</p>		
Examination forms	Oral		

Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	Temirgaliev N. Mathematical analysis. Vol. II. -Almaty: Ana tili, 1991, 288 pages (in Kazakh) Temirgaliev N. Mathematical analysis. Vol. III. -Almaty: Bilim, 1997, 288 pages (in Kazakh) Temirgaliev N. Mathematical analysis (revised and supplemented second edition). -Nur-Sultan: L.N. Gumilyov Eurasian National University, 2022. - 2000 pages (in Kazakh) Nikolsky S.M. Module of mathematical analysis. Vol. I, II. - 3-ed.- M.: Nauka, 1983 (in Russian)

Module 18

Module code and name	MATH22009 Real analysis		
Semester(s) when the Module is taught	4		
Lecturer	1. Mukanov Zh.B. 2. Tleukhanova N.T..		
Credit points (total by discipline)	7 ECTS		
Teaching methods	Lectures, practical tasks, exercises, work with the textbook		
Workload (incl. contact hours, self-study hours)	Total workload: 210		
	Lectures	Practical training	Self-study hours
	30	30	150
Required and recommended prerequisites for joining the Module	Mathematical analysis II		
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> - formation of systematic knowledge about modern methods of function theory, its place and role in the system of mathematical sciences; - expansion and deepening of concepts: function, measure, integral; - development of abstract thinking, spatial representations, computational, algorithmic cultures and general mathematical culture. 		
Content of the Module	Cardinality. Countable sets and sets with cardinality of the continuum. The Cantor-Bernstein theorem. Metric spaces. Set systems. Lebesgue measure. Measurable functions. Convergence in measure. Convergence almost everywhere. Lebesgue integral. Lebesgue's theorem. Levi's theorem. Fatou theorem. Fubini's theorem. The L_p spaces. Functions of bounded variation. Absolute continuous functions.		
Examination forms	Oral exam		

Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeal Commission in accordance with the established requirements.
Technical and electronic learning tools	1. Natanson I.P. The theory of functions of a real variable. – M.: Lan, 2008. – 560 p. – ISBN 978-5-8114-0136-9. (in Russian) https://library.enu.kz/ProtectedView/Book/ViewBook/490 2. Makarov B.M., Podkorytov A.N. Lectures on real analysis. – 7th ed. - St. Petersburg: BHV-Petersburg, 2011. - 688 p. – ISBN 978-5-9775-0631-1. (in Russian) https://b-ok.asia/book/2207325/a0b066?regionChanged
Reading list	1. Kolmogorov A.N., Fomin S.V. Elements of the theory of functions and functional analysis. – 7th ed. – M.: Fizmatlit, 2017. – 576 p. – ISBN 978-5-9221-0266-7. (in Russian) 2. Ulyanov P.L., Bakhvalov A.N., Dyachenko M.I., Kazaryan K.S., Sifuentes P. Real analysis in problems. – M.: Fizmatlit, 2005. – 416 p. (in Russian) 3. Dyachenko B.M., Ulyanov P.L. Measure and integral. - M.: Factorial, 1998. - 160 p. (in Russian) 4. Ochan Yu.S. Collection of problems and theorems on the theory of functions of a real variable. - Part 1-2. - M: Education, 1965. - 231 p. (in Russian)

Module 19

Module code and name	MATH32012 Functional analysis		
Semester(s) when the Module is taught	5		
Lecturer	1. Temirkhanova A.M. 2. Abylayeva A.M.		
Credit points (total by discipline)	6 ECTS		
Teaching methods	Lectures, practical tasks, exercises, work with the textbook		
Workload (incl. contact hours, self-study hours)	Total workload: 180		
	Lectures	Practical training	Self-study hours
	30	30	120
Required and recommended prerequisites for joining the Module	Real analysis		

Module objectives/intended learning outcomes	<p>– to form a system of knowledge about the basic elements of the theory of functional spaces, about linear functionals and operators, to introduce theoretical material and teach students to apply modern research methods. Master the basic theorems of functional analysis, methods of operator theory, be able to apply them in solving problems;</p> <p>– to form practical skills in solving the main problems of functional analysis and the theory of linear operators, the ability to prove the main theorems of the Module.</p>
Content of the Module	Metric, linear normed spaces, Euclidean, Hilbert spaces. Linear functionals and operators in normed spaces. Continuity theorem for linear operators. Boundedness criterion for linear operators. Operator norm. Hahn-Banach theorem. Riesz's theorem. Reverse Operators. Properties. Banach's inverse operator theorem. Closed operators and their properties. Banach closed graph theorem. Conjugate operators and their properties. Completely continuous operators and their properties. Resolvent set and spectrum of a linear operator.
Examination forms	Combined exam
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, zero points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	<ol style="list-style-type: none"> 1. Kutuzov A.S. Metric spaces. Textbook. Troitsk 2012. -104 p. https://www.twirpx.com/file/1682502/ (in Russian) 2. Kutuzov A.S. Linear normed spaces. Textbook. Troitsk 2011. -144 p. https://www.twirpx.com/file/1682503/ (in Russian) 3. Kutuzov A.S. Hilbert spaces. Textbook. Troitsk 2012. -86p. https://www.twirpx.com/file/1682508/ (in Russian) 4. Kutuzov A.S. Linear bounded operators. Part 1. Textbook, 2012. -159 s. https://www.twirpx.com/file/1682506/ (in Russian) 5. Kutuzov A.S. Linear bounded operators. Part 2. Textbook, 2012. -206c. https://www.twirpx.com/file/1682509/ (in Russian)
Reading list	<ol style="list-style-type: none"> 1. Trenogin V.A. Functional analysis. In 2 volumes. Vol. 1. M.: Academy 2012. 239 p. ISBN 978-5-7695-9136-5 (in Russian) 2. Trenogin V.A. Functional analysis. In 2 volumes. Vol. 1. M.: Academy 2013. 230 p. ISBN 978-5-7695-9136-5 (in Russian) 3. Trenogin V.A., Pisarevsky B.M., Soboleva T.S. Problems and exercises in functional analysis. - M.: FIZMATLIT, 2005. – 238 p. (in Russian) 4. Kolmogorov A.N., Fomin S.V. Elements of the theory of functions and functional analysis. – 7th ed. – M.: Fizmatlit, 2017. – 576 p. – ISBN 978-5-9221-0266-7 (in Russian)

Module 20

Module code and name	MATH22014 Differential Equations
Semester(s) when the Module is taught	5

Lecturer	1. Koshkarova B.S. 2. Akhmetkaliyeva R.D.						
Credit points (total by discipline)	6 ECTS						
Teaching methods	Lecture, explanation, presentations, practical tasks, work with the textbook						
Workload (incl. contact hours, self-study hours)	Total workload: 180 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Lectures</th> <th style="width: 33%;">Practical training</th> <th style="width: 33%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Self-study hours	30	30	120
Lectures	Practical training	Self-study hours					
30	30	120					
Required and recommended prerequisites for joining the Module	Mathematical Analysis II						
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> – to develop students' knowledge of the basic concepts of the theory of ordinary differential equations (ODE); theory of linear differential equations (LDE) of the nth order, stability theory, standard forms of writing basic differential equations, – to form practical skills in solving basic differential equations and systems of equations, differential equations in partial derivatives of the first order, the ability to prove the existence theorem and the uniqueness of the solution of the initial problem, the study of solutions for stability; – to form the ability to use the apparatus of the theory of differential equations in the study of applied problems. 						
Content of the Module	Ordinary differential equations of the 1st order. Cauchy problem. Higher order differential equations. Linear differential equations of the n th order. Boundary Value Problems for LDEs of the 2nd Order. Systems of differential equations of general form. Linear systems of differential equations with constant coefficients. Theory of stability. Equations with partial derivatives of the first order.						
Examination forms	Composite exam						
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeal Commission in accordance with the established requirements.						
Technical and electronic learning tools	<ol style="list-style-type: none"> 1. Filippov AF Collection of problems on differential equations. - Izhevsk, 2000. - 176 p.. (in Russian) http://kvm.gubkin.ru/pub/uok/FilippovDU.pdf 2. Elsgolts L.E. Differential Equations and the Calculus of Variations. http://www.phys.nsu.ru/balakina/EI%27sgol%27dz_Dif_ur_i_var_isch.pdf 						

Reading list	<p>1. Elsgolts L.E. and others, Ordinary differential equations. - St. Petersburg: Lan, 2002. - 218 p. - ISBN 5-8114-0458-1. (in Russian)</p> <p>2. Krasnov M. L.; Kiselev A.I.; Makarenko G.I. Ordinary differential equations. Tasks and examples with detailed solutions: a textbook for students of higher educational institutions. – Ed. 5th, correct. - Moscow: KomKniga, 2005. - 253 p. - ISBN 5-484-00193-5. (in Russian)</p> <p>3. A. I. Egorov, Ordinary Differential Equations with Applications. – Ed. 2nd, rev. - Moscow: Fizmatlit, 2005. – 384 p. - ISBN 5-9221-0553-1. (in Russian)</p>
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Module 21

Module code and name	MATH22015 The theory of functions of a complex variable						
Semester(s) when the Module is taught	5						
Lecturer	<p>1. Nauryzbayev N.Zh.</p> <p>2. Musabayeva G.K.</p>						
Credit points (total by discipline)	6 ECTS						
Teaching methods	Lectures, practices, laboratory work, seminars, projects						
Workload (incl. contact hours, self-study hours)	<p>Total workload: 180</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Lectures</th> <th style="text-align: left;">Practical training</th> <th style="text-align: left;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Self-study hours	30	30	120
Lectures	Practical training	Self-study hours					
30	30	120					
Required and recommended prerequisites for joining the Module	Algebra I, Mathematical Analysis III						
Module objectives/intended learning outcomes	<p>Mastering the necessary mathematical apparatus that helps to solve applied problems in the theory of functions of a complex variable, which has numerous applications in modeling and forecasting.</p> <p>As a result of mastering the module, the student should know the features of differentiability and integrability of a function of a complex variable, representation and properties of an analytic function, Taylor and Laurent series, their relationship, classification of singular points and their nature depending on the type of Laurent series, residues and their applications.</p>						
Content of the Module	Complex numbers and operations on them. Sets and domains on the complex plane. Complex-valued functions of a complex variable. Elementary functions. Differentiability of a function of a complex variable. Conformal mappings. Integration of a function of a complex variable. Taylor and Laurent series. Special points. Deductions.						
Examination forms	Composite						
Study and examination requirements	<p>Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.</p>						

Technical and electronic learning tools	Sveshnikov A.G., Tikhonov A.N. Theory of functions of a complex variable. - Moscow: Nauka, 2006. (in Russian) http://read.newlibrary.ru/read.php/pdf=15234
Reading list	1. Shabat B.V. Introduction to complex analysis. – M.: M.V. Lomonosov Moscow State University, 2020 (in Russian) 2. Sveshnikov A.G., Tikhonov A.N. Theory of functions of a complex variable. - Moscow: Nauka, 2006 (in Russian) 3. Volkovysky L.I., Lunts G.L., Aramanovich I.G. Collection of problems on the theory of functions of a complex variable. - M.: FIZMATLIT, 2002. - 312 p (in Russian)

Module 22

Module code and name	MATH42024 Equations of mathematical physics						
Semester(s) when the Module is taught	7						
Lecturer	1. Alday M. 2. Koshkarova B.S.						
Credit points (total by discipline)	6 ECTS						
Teaching methods	Lecture, explanation, presentations, practical tasks, work with the textbook						
Workload (incl. contact hours, self-study hours)	Total workload: 180 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Lectures</th> <th style="width: 33%;">Practical training</th> <th style="width: 33%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">45</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Self-study hours	30	45	120
Lectures	Practical training	Self-study hours					
30	45	120					
Required and recommended prerequisites for joining the Module	Differential Equations						
Module objectives/intended learning outcomes	- students gaining knowledge about the main methods of setting problems based on conservation laws, for dynamic systems with distributed parameters and described by differential equations in partial derivatives; – acquisition of the ability to classify the main types of second-order partial differential equations; – mastering the basic methods of analytical solution of basic problems for differential equations in partial derivatives of the second order with two independent variables.						
Content of the Module	Second order partial differential equations. Classification. Reduction to canonical form. Basic equations of mathematical physics. Cauchy problem. d'Alembert formula. Method of characteristics. continuation method. Poisson formula. Uniqueness of the solution of the Cauchy problem for the heat equation. Gours problem. Method of integral transformations. Mixed problems for hyperbolic and parabolic equations. Uniqueness of Solutions to Problems. Fourier method. Uniqueness of solutions of Dirichlet problems for the Poisson equation. Green's method for the Dirichlet problem. Green's method for the Neumann problem. Poisson integral for circle and ball. Uniqueness of solutions of the inner and outer Neumann problem. Method of potentials. Single and double layer potentials.						
Examination forms	Composite exam						

Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeal Commission in accordance with the established requirements.
Technical and electronic learning tools	1. Vladimirov V.S. Collection of problems on the equations of mathematical physics. – M.: Fizmatlit, 2016. – 520 p. (in Russian) http://www.studentlibrary.ru/book/ISBN9785922116923.html 2. Smirnov M.M. Problems on the equations of mathematical physics. 6th ed. – M.: Nauka, 1975. – 125 p. (in Russian) https://www.studmed.ru/smirnov-mm-zadachi-po-uravneniyam-matematicheskoy-fiziki-izd-6-oe_2aafc741d.html
Reading list	1. Syzdykova Z.N. Equations of mathematical physics: textbook. - Nur-Sultan: Master of Software, 2019. - 183 p. - ISBN 978-9965-31-922-8 (in Russian) 2. Syzdykova Z.N. Equations of mathematical physics in examples and problems. - Nur-Sultan: Master of Software, 2019. - 173 p. - ISBN 978-601-337-124-5 (in Russian) 3. Bitsadze A.V., Kalinichenko D.F. Collection of problems on the equations of mathematical physics. – M.: Nauka, 1985. – 222 p (in Russian) 4. Sabitov K.B. Equations of mathematical physics. - Moscow: Higher School, 2003. - 254 p. - ISBN 5-06-004676-1 (in Russian)

Module 23

Module code and name	MATH33032 Variational calculus						
Semester(s) when the Module is taught	7						
Lecturer	Tileubaev T.E.						
Credit points (total by discipline)	6 ECTS						
Teaching methods	Lectures, practical tasks, reproductive, work at the blackboard, work with a textbook, online counseling						
Workload (incl. contact hours, self-study hours)	Total workload: 150 <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Lectures</td> <td style="width: 33%;">Practical training</td> <td style="width: 33%;">Self-study hours</td> </tr> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> <td style="text-align: center;">120</td> </tr> </table>	Lectures	Practical training	Self-study hours	30	30	120
Lectures	Practical training	Self-study hours					
30	30	120					
Required and recommended prerequisites for joining the Module	Differential Equations						
Module objectives/intended learning outcomes	Own modern methods of calculus of variations and optimization in finite-dimensional and infinite-dimensional spaces, including numerical methods for solving extremal problems, linear, convex, non-linear programming, basics of convex analysis, optimal control of dynamic systems. Be able to apply them to applied problems solved by methods of the theory of extremal problems.						

Content of the Module	Problems that influenced the calculus of variations: the problem of the brachistochrone; problem of geodesic lines, isoperimetric problem. Statement of the problem of the calculus of variations: a problem with fixed boundaries. Theorem on the existence of a weak local minimum of the functional. Lemma Lagrange. Dubois Raymond Lemma. Euler equation. Functionals depending on the higher order derivatives of a function of one function. Statement of the problem of the calculus of variations. Functionals depending on the higher order derivatives of several functions. Statement of the problem of the calculus of variations. Functionals dependent on several functions. Statement of the problem of the calculus of variations. Bolz's problem. The Boltz problem for the multidimensional case. Conditional extremum problems with finite connections. Conditional extremum problems with differential constraints. Conditional extremum problems with integral connections. Condition of the second order in the calculus of variations. Legendre condition and Jacobi condition. Necessary and sufficient condition for weak and strong extremum. Weierstrass condition. A necessary condition for a strong extremum.
Examination forms	Oral exam
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector Electronic resources: https://clck.ru/gfVVw https://clck.ru/gfVTT
Reading list	1. Elsgolts L.E. Differential equations and calculus of variations / M.: Editorial URSS, 2015.–319 p. (in Russian) 2. Romanko V.K. Module of differential equations and calculus of variations / M., St. Petersburg: Fizmatlit, 2013. -342 p. (in Russian) 3. Panteleev A.V. Calculus of Variations in Examples and Problems / M.: MAI, 2014. - 227 p. (in Russian) 4. Gel'fand I. M., Fomin S. V., Calculus of Variations. M.: Nauka. 1911 (in Russian)

Module 24

Module code and name	MATH33034 Integral equations
Semester(s) when the Module is taught	7
Lecturer	1. Koshkarova B.S.
Credit points (total by discipline)	6 ECTS
Teaching methods	Lectures, practices, laboratory work, seminars, projects

Workload (incl. contact hours, self-study hours)	Total workload: 150 Lectures Practical training Self-study hours 30 30 120
Required and recommended prerequisites for joining the Module	Functional analysis
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> - mastering the necessary mathematical apparatus for studying integral equations, which helps to model, analyze and solve problems of an applied and physical nature; - mastering the methodology for solving integral equations; - deepening theoretical knowledge about the problems of modern mechanics, investigated by means of integral equations; - development of typical methods and models containing integral equations and used in mechanics, in physical analysis and applied mathematics; - development of logical and algorithmic thinking
Content of the Module	Basic classes of integral equations. Problems leading to integral equations. Method of successive approximations. Iterated kernels and resolvents. Method of Fredholm determinants. Fredholm's theory. Integral Equations with Degenerate Kernel. Fredholm's theorems for the general case of the Fredholm equation. Integral equations with a kernel having a weak singularity. Integral Equations with Symmetric Kernel. Integral equations of the 1st kind. Method of integral transformations to the solution of integral equations.
Examination forms	Composite exam
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeal Commission in accordance with the established requirements.
Technical and electronic learning tools	Popov V.A. Collection of problems on integral equations. – Kazan, 2006. – 30 p. (in Russian). https://studylib.ru/doc/2523515/v.-a.-popov.-sbornik-zadach-po-integral.-nym-uravneniyam
Reading list	<ol style="list-style-type: none"> 1. Vlasova E. A. Functional analysis and integral equations (modules 1, 2). Lecture notes. – M., 2015. ISBN: 978-5-7038-4210-2. https://elit-knigi.ru/details.php?id=134522 (in Russian) 2. Voroshilov A.A. Integral equations: a manual. – Minsk: BSU, 2014. ISBN 978-985-566-033-1. http://elib.bsu.by/handle/123456789/109078 (in Russian) 3. Krasnov, M. L et al., Integral equations. Tasks and examples with detailed solutions: textbook - M.: URSS, 2003. - 192 p. ISBN 5-354-00390-3. https://11klasov.com/7630-integralnye-uravnenija-zadachi-i-primery-s-podrobnymi-reshenijami-krasnov-mi-kiselev-ai-makarenko-gi.html (in Russian)

Module 25

Module code and name	MATH32013 Probability theory						
Semester(s) when the Module is taught	5						
Lecturer	1. Zhubanysheva A.Zh.						
Credit points (total by discipline)	6 ECTS						
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling						
Workload (incl. contact hours, self-study hours)	<p>Total workload: 180</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Lectures</th> <th style="text-align: center;">Practical training</th> <th style="text-align: right;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">30</td> <td style="text-align: center;">30</td> <td style="text-align: right;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Self-study hours	30	30	120
Lectures	Practical training	Self-study hours					
30	30	120					
Required and recommended prerequisites for joining the Module	Theory of functions of a real variable						
Module objectives/intended learning outcomes	Qualitative assimilation with knowledge of all definitions, motives for definitions and formulations of problems, formulations of theorems and their complete proofs, relevant counterexamples of probability theory and mathematical statistics and its role in natural science, applied orientation and orientation to the use of mathematical methods in solving applied problems.						
Content of the Module	The subject of probability theory is the analysis of random phenomena: the absence of deterministic regularity and the presence of statistical regularity. Mathematical and auxiliary models of random phenomena. Axioms of A.N. Kolmogorov and their consequences. Classical, geometric definitions and practical meaning of probability. Elements of combinatorial analysis. Conditional Probability. Independence. Basic formulas of probability theory: multiplication formula, total probability formula, Bayes formula. Test sequences. Bernoulli scheme. Poisson formula. Markov chain. A random variable is a numerical measurable function of elementary events. Distribution function of a random variable. Random vector. Probability distribution and distribution function of a random vector. Independence of a set of random variables. Numerical characteristics of a random variable, a random vector (mathematical expectation, variance, moments, covariance, correlation coefficient, mode, median, kurtosis, etc.) and their properties. Chebyshev's inequality and its consequences. The law of large numbers for the Bernoulli scheme. Proof of the Weierstrass theorem using the law of large numbers for the Bernoulli scheme. Limit theorems (local and integral Moivre-Laplace) for the Bernoulli scheme. Various types of convergence of random variables. The Borel-Cantelli lemma. Strong law of large numbers. Characteristic functions - definition and simple properties. Central limit theorem (under the Lyapunov condition). Introduction to random processes. Probabilistic-statistical model.						
Examination forms	Oral						

Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	<ol style="list-style-type: none"> 1. Temirgaliev N. Probability Theory. Electronic edition. ITMiNV. Astana, 2012. (in Russian) 2. Baldin, K.V. Theory of Probability and Mathematical Statistics. - Moscow: Dashkov and K, 2014. (in Russian) 3. DeGroot, Morris H. Probability and statistics / Morris H. DeGroot, Mark J. Schervish. 4th ed. 2012. 911 rubles 4. Fadeeva L.N. Probability theory and mathematical statistics. - Moscow: Eksmo, 2010. (in Russian) 5. Baldin, K.V. Theory of Probability and Mathematical Statistics. - Moscow: Dashkov and K, 2014. (in Russian) 6. Chernova N. I. Probability Theory. SibGUTI. - Novosibirsk, 2009. - 128 p. (in Russian) 7. Trofimova E.A., Kislyak N.V., Gilev D.V. Probability Theory and Mathematical Statistics: Proc. allowance / E.A. Trofimova, N.V. Kislyak, D.V. Gilev; [under common ed. E. A. Trofimova]; Ministry of Education and Science Ros. Federation, Ural. feder. university. - Yekaterinburg: Publishing House of Ural university, 2018. - 160 p. https://elar.urfu.ru/bitstream/10995/60280/1/978-5-7996-2317-3_2018.pdf?ysclid=12jzx84eki (in Russian)

Module 26

Module code and name	MATH33025 Solving problems on probability theory in the matlab system								
Semester(s) when the Module is taught	7								
Lecturer	Iskakova A.S.								
Credit points (total by discipline)	6 ECTS								
Teaching methods	Lectures, practices, laboratory work, seminars, projects								
Workload (incl. contact hours, self-study hours)	<p>Total workload: 180</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Lectures</th> <th style="width: 25%;">Practical training</th> <th style="width: 25%;">Lab</th> <th style="width: 25%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	30	15	15	120
Lectures	Practical training	Lab	Self-study hours						
30	15	15	120						
Required and recommended prerequisites for joining the Module	Probability theory and mathematical statistics								

Module objectives/intended learning outcomes	Presentation of the practical application of solving problems from the Module "Probability Theory" with theoretical and practical explanations and examples of solutions; - to instill the ability to apply the acquired knowledge to solve applied problems of mathematical modeling.
Content of the Module	In the Module of the study, practical applications of the implementations of the studied algorithms in machine learning will be considered. The use of Matlab in probability theory is an urgent and timely need, dictated by the progressive development of the digitalization of society, characterized by global tasks in social-natural, economic and technical processes. The modern study of probability theory requires digitalization, i.e. algorithms for solving translational practice problems. This Module serves precisely this purpose, the content of which is aimed at a systematic understanding of the integration of probabilities and computer programming.
Examination forms	Combined
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Matlab
Reading list	1. Iskakova A.S., Karataeva D.S. Task book on the theory of probability: Textbook / Iskakova A.S., Karataeva D.S. – Almaty: SSK, 2017 (<i>in Russian</i>) 2. Iskakova A.S. Solving problems in the theory of probability in the Matlab system: Textbook / Iskakova A.S. – Almaty: SSK, 2018 (<i>in Russian</i>)

Module 27

Module code and name	MATH33030 Actuarial risk theory			
Semester(s) when the Module is taught	7			
Lecturer	Taugynbayeva G.E.			
Credit points (total by discipline)	6 ECTS			
Teaching methods	Lectures, practices, laboratory work, seminars, projects			
Workload (incl. contact hours, self-study hours)	Total workload: 180			
	Lectures	Practical training	Lab	Self-study hours
	30	15	15	120
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics			

Module objectives/intended learning outcomes	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling
Content of the Module	The concept of risk. Risk classes. Risk classification. Risk identification - identification of a hazard, object, subject. Quantitative risk assessment. Measure of risk, degree of risk. Random variables, distributions of random variables. Calculation of the risk premium in the redistribution scheme. Small population problem. Calculation of the compensation fund. Model of individual risk. Calculation of the size of the compensation fund in case of a large population. Model of individual risk. Principles of assigning premiums. Generating functions. Laplace transform. claim model. Collective risk model. Risk management. Theory of modeling strategic games.
Examination forms	Oral
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	1. Chertykovtsev V.K., Mathematical theory of risks and its applications, M.: YURAIT, 105 pages. (in Russian) 2. Gurnovich T.G. Risk assessment and analysis (for bachelors), M.: KnoRus, 2019. - 256 p. (in Russian) 3. Tikhomirov N.P., Tikhomirova T.M., Theory of Risk, Research Institute of Education and Science, 2020, 308 pages. (in Russian)

Module 28

Module code and name	MATH12001 Analytic Geometry		
Semester(s) when the Module is taught	1		
Lecturer	Tukanaev T.D.		
Credit points (total by discipline)	5 ECTS		
Teaching methods	Lectures, practices, laboratory work, seminars		
Workload (incl. contact hours, self-study hours)	Total workload: 150		
	Lectures	Practical training	Self-study hours
	30	15	105
Required and recommended prerequisites for joining the Module	School mathematics Module		

Module objectives/intended learning outcomes	- development of students' logical thinking skills; - familiarity with the main methods of research - mastering the necessary mathematical apparatus of mathematical knowledge, transfer the basic concepts and knowledge of the discipline, use them in practice, apply them in other mathematical disciplines and mathematical research.
Content of the Module	Coordinate system. Vectors. Scalar, vector and mixed product of vectors. Transformation of rectangular Cartesian coordinates. Straight line on the plane. Various equations of a straight line. Angle between lines. Mutual arrangement of lines. Ellipse and hyperbola. Canonical equations. Parabola, canonical equation. Classification of curves of the second order. Planes and lines. Angle between planes. straight line in space. various equations. Angles between two lines, between a line and a plane. Mutual arrangement of a straight line and a plane. Surfaces of the second order. cylindrical surfaces. conical surfaces. Ellipsoid and its properties. Hyperboloids. Paraboloids.
Examination forms	Combined
Study and examination requirements	Attendance is compulsory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Educational-methodical complex on "Analytical geometry": methodical manual / T.D. Tukanaev. - Astana: ENU. L.N. Gumilyov, 2007.- 71 p.
Reading list	1. Beklemishev D.V. Module of Analytic Geometry and Linear Algebra. –M.: Nauka, 1980 (in Russian) 2. Kletenik D.V., Collection of problems in analytical geometry - M., Nauka, 1986 (in Russian)

Module 29

Module code and name	MATH22002 Algebra I		
Semester(s) when the Module is taught	2		
Lecturer	1. Myrzakulova J.R. 2. Beszhanova A.T.		
Credit points (total by discipline)	5 ECTS		
Teaching methods	Lectures, practices, laboratory work, seminars, projects		
Workload (incl. contact hours, self-study hours)	Total workload: 150		
	Lectures	Practical training	Self-study hours
	30	15	105

Required and recommended prerequisites for joining the Module	School mathematics Module
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> - To develop in students the skills of mathematical thinking, the ability to use the mathematical apparatus in solving problems. - Theoretical development by students of the basic rules of the Module of algebra; - acquire practical skills in solving typical problems, as well as tasks that contribute to the development of basic research skills; - to form the level of algebraic training necessary for understanding the foundations of other mathematical disciplines.
Content of the Module	Group, ring, field. The field of complex numbers. Permutations and substitutions. Substitution group. Matrices and operations on them. Ring of square matrices. Determinants and their properties. Minors and algebraic additions. Row decomposition of the determinant. Determinant of product of matrices. Inverse matrix. Matrix equations. Study of systems of linear algebraic equations. Cramer's rule. Gauss method. Study of systems of linear equations. homogeneous systems. Definition of polynomials. Basic properties. Division with remainder. Euclid's algorithm. Relatively simple polynomials. Equation $fu+gv=h$. Roots of polynomials. Bezout's theorem. Taylor formula. Multiple roots. Decomposition of a polynomial into non-reduced polynomials over a given field. Fundamental theorem of algebra and its corollaries.
Examination forms	Combined
Study and examination requirements	Attendance is compulsory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	M.V. Milovanov et al. Algebra and Analytic Geometry Minsk, 1984 (in Russian) https://catalog.enu.kz/enulib-web/public/portal/book/view/54394
Reading list	<ol style="list-style-type: none"> 1. Beklemishev D.V. Module of Analytic Geometry and Linear Algebra: textbook - Ed. 15th, sr. - St. Petersburg ; Moscow; Krasnodar: Lan, 2018. - 444 p. - ISBN 978-5-8114-1844-2 (in Russian) 2. Kostrikin A.I. Linear algebra and geometry: textbook. - Ed. 3rd, sr. - St. Petersburg [and others]: Lan, 2005. - 302 p. - ISBN 5-8114-0612-6 (in Russian) 3. Faddeev D.K. Lectures on algebra: a study guide. - St. Petersburg: Lan, 2005. - 415 p. - ISBN 5-8114-0447-6 (in Russian)

Module 30

Module code and name	MATH22005 Algebra II
Semester(s) when the Module is taught	3

Lecturer	Naurazbekova A.S.		
Credit points (total by discipline)	5 ECTS		
Teaching methods	<i>Lectures, practices, laboratory work, seminars, projects</i>		
Workload (incl. contact hours, self-study hours)	Total workload: 150		
	Lectures	Practical training	Self-study hours
	30	15	105
Required and recommended prerequisites for joining the Module	Algebra I		
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> - development of the necessary mathematical apparatus for the study of algebraic problems; - deepening theoretical knowledge about the problems of modern algebra; - development of logical and algorithmic thinking. 		
Content of the Module	<p>Euclidean and unitary spaces. Cauchy-Bunyakovsky inequality. Metric concepts in Euclidean and unitary spaces. Isomorphism of Euclidean (unitary) spaces of the same dimension. Orthogonal systems of vectors. orthogonalization process. Orthonormal bases. Subspaces of unitary and Euclidean spaces. orthogonal addition. Linear operators in linear spaces and operations on them. Linear operator matrix. Product and sum matrices of two linear operators. Image and kernel, rank and defect of a linear operator. Dimension of the kernel and image. Method for finding the kernel and image of a linear operator. Linear operator matrices in different bases. Invariant subspaces of a linear operator. Eigenvectors and eigenvalues of a linear operator. Method for finding invariant subspaces of a linear operator. Diagonalizability Criterion. Hamilton-Cayley theorem. Reduction of a matrix to a diagonal form. Jordan normal form of a matrix. A method for finding the Jordan normal form of a matrix. Decomposition of the root space into a direct sum of cyclic subspaces. Square shapes. Transformations of unknown quadratic forms. Lagrange's method of reducing quadratic forms to canonical form. Constant-sign quadratic forms, Sylvester's criterion. Linear operators in Euclidean and unitary spaces. Associated operator. Criterion for the normality of an operator. Algebraic and geometric characterizations of self-adjoint and fixed-sign operators. Polar decomposition theorem</p>		
Examination forms	Combined, in writing		
Study and examination requirements	<p>Attendance is compulsory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.</p>		

Technical and electronic learning tools	М.В. Милованов и др Алгебра и аналитическая геометрия Минск, 1984 https://catalog.enu.kz/enulib-web/public/portal/book/view/54394
Reading list	1. Vinberg E.B. Algebra Module. Textbook - Ed. 3rd. Moscow: MTSNMO, 2017.-591, ISBN 978-5-4439-0209-8 (in Russian) 2. Faddeev D. K. Lectures on algebra: textbook - Ed. 4th, sr. - St. Petersburg; Moscow; Krasnodar: Lan, 2005. - 415, ISBN 5-8114-0447-6 (in Russian) 3. Kurosh A.G. Module of higher algebra. Textbook - St. Petersburg, Moscow, Krasnodar: Lan, 2008-432, ISBN 978-5-8114-0521-3 (in Russian)

Module 31

Module code and name	MATH22006 Discrete mathematics and mathematical logic						
Semester(s) when the Module is taught	3						
Lecturer	Jandigulov A.R.						
Credit points (total by discipline)	5 ECTS						
Teaching methods	Lectures, practices, laboratory work, seminars, projects						
Workload (incl. contact hours, self-study hours)	Total workload: 150 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Lectures</th> <th style="width: 33%;">Practical training</th> <th style="width: 33%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">15</td> <td style="text-align: center;">105</td> </tr> </tbody> </table>	Lectures	Practical training	Self-study hours	30	15	105
Lectures	Practical training	Self-study hours					
30	15	105					
Required and recommended prerequisites for joining the Module	Algebra I						
Module objectives/intended learning outcomes	- introduce the basics of discrete mathematics and mathematical logic; - to teach to apply the methods of mathematical logic and discrete mathematics in solving practical problems; -to acquaint with new directions in the development of mathematical logic and discrete mathematics.						
Content of the Module	Study the basic concepts of discrete mathematics and mathematical logic, the definitions and properties of mathematical objects used in this area, the formulation of statements, methods for their proof, and possible areas of their applications. The methods for solving problems of theoretical and applied nature from various sections of discrete mathematics and mathematical logic are considered.						
Examination forms	<i>combined</i>						
Study and examination requirements	- Mandatory attendance by students of all classes according to the schedule; - Preliminary preparation for classes; - Timely implementation and delivery of SRO; -Preparation for all types of classes should be independent, creative; - Active work and manifestation of creativity during classes; - Participation in all types of control; - Commitment to the University's Academic Integrity Policy						

<p>Technical and electronic learning tools</p>	<p>Salgaraeva G. II. Graph Theory: Almaty: Daur LLP, 2013. - 256 pages. (in Kazakh) http://lib.kazmkpu.kz/res/Graftar_teorijsy_Salgaraeva.pdf P. T. Dosanbay PSU C. Toraigyrova. Mathematical logic: textbook.-Almaty: Daur, 2011.-280 p. ISBN 978-601-217-244-7 (in Russian) https://www.twirpx.com/file/2423408/grant/ Alekseev V.E., Zakharova D.V. GRAPH THEORY: Textbook. - Nizhny Novgorod: Nizhny Novgorod State University, 2017. -119 p. (in Russian) http://www.unn.ru/books/met_files/Theory_graph.pdf Omelchenko A. V. Graph Theory. M.: MTSNMO, 2018. 416 p. (in Russian) ISBN 978-5-4439-1247-9. https://obuchalka.org/20190326107981/teoriya-grafov-omelchenko-a-v-2018.html</p>
<p>Reading list</p>	<p>Kulikov, V. V. Discrete mathematics: textbook / - Moscow: RIOR : INFRA-M, 2016. - 172, [2] p.: tab., ill.. - Bibliography: p. 171. - 3000 copies. – ISBN 978-5-369-00205-6. – ISBN 978-5-16-103320-3 (in Russian) Shaporev, S.D. Discrete Math. A Module of lectures and practical exercises [Text]: a textbook for university students studying in the specialties 220200 "Automated information processing and control systems", 071900 "Information systems in engineering and technology" /. - St. Petersburg: BHV-Petersburg, 2017. - 396 p.: ill .. - Subject. decree: p. 393-396. – ISBN 978-5-9775-3805-3 (in Russian) Yavorsky V.V. Discrete Mathematics [Text]: textbook for universities / V.V. Yavorsky. - Almaty: Epigraph, 2019. - 172, [1] p.: ill. - Bibliography: p. 172. - ISBN 978-601-327-496-6 (in Russian) Jandigulov, A.R. Collection of problems in discrete mathematics. - Almaty: Epigraph, 2017. - 94, [1] p. - Bibliography: p. 92. - ISBN 978-601-310-945-9 (in Russian)</p>

Module 32

Module code and name	MATH33033 Differential geometry and topology														
Semester(s) when the Module is taught	7														
Lecturer	Tukanayev T.D.														
Credit points (total by discipline)	6 ECTS														
Teaching methods	Lectures, practices, laboratory work, seminars, projects														
Workload (incl. contact hours, self-study hours)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="4" style="text-align: left;">Total workload: 180</td> </tr> <tr> <td style="width: 33%;">Lectures</td> <td style="width: 33%;">Practical training</td> <td colspan="2" style="width: 34%;">Self-study hours</td> </tr> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> <td colspan="2" style="text-align: center;">120</td> </tr> </table>			Total workload: 180				Lectures	Practical training	Self-study hours		30	30	120	
Total workload: 180															
Lectures	Practical training	Self-study hours													
30	30	120													
Required and recommended prerequisites for joining the Module	Analytic geometry. Algebra I.														

Module objectives/intended learning outcomes	The discipline is designed to develop students' theoretical knowledge of the basic provisions of differential geometry and topology; formation of practical skills for solving typical problems. Formation of the level of mathematical preparation necessary for understanding the foundations of other mathematical disciplines; study of ways to define lines and surfaces, possession of the theory of curvature; knowledge of the basic quadratic forms of the surface, the main invariants, special lines along the surface (asymptotic, curvature, geodesic), elements of the internal geometry of the surface; basic concepts of topology.
Content of the Module	Vector function of scalar argument. The concept of a curve. Vector equation of the curve. Parametric curve equation. Regular curve. The tangent to the curve for various cases of specifying the curve. The length of the arc. Natural parametrization of the curve. Frenet trihedron. Equations of elements of the Frenet trihedron. Curvature of a curve. Curvature vector. Radius of curvature. Curvature calculation for an arbitrary parameter. Frenet's first formula. Absolute twist. Torsion calculation for an arbitrary parameter. Frenet's second and third formulas. Curvature and torsion of a helix. Regular surface. Various ways to define a surface. Tangent plane and normal equations for various cases of defining a surface. The first quadratic surface form. The length of the curve on the surface. Angle between curves on a surface. Surface area. The second quadratic form of the surface. Curvature of a curve on a surface. Normal surface curvature. Curvature indicatrix. Principal directions and principal curvatures. Asymptotic directions and asymptotic lines on a surface. Finding principal directions and principal curvatures. Total (Gaussian) and mean surface curvature. The internal geometry of the surface. Basic equations of the theory of surfaces. Formulas of Gauss - Peterson - Mainardi - Codazzi. Topological structure. Basis. Subspace. Axioms of separability, Hausdorff. Compactness. Connectivity. Continuity and homeomorphism. Varieties. Euler characteristic of a manifold. Orientable and non-orientable manifolds. Topological classification of two-dimensional manifolds.
Examination forms	Combined, written
Study and examination requirements	1. Obligatory attendance of classroom classes. If the student missed the lesson without good reason or was late, then this is taken into account when scoring; 2. When skipping classes for a good reason, the student, in agreement with the teacher, works out the topic of the missed lesson outside of school hours. 3. To receive points for a practical lesson, the student must actively participate in the lesson when discussing the topic, solving problems, and fully complete the tasks offered on the topic. 4. Prepare in advance for the lecture and practical task on the teaching aids recommended on this topic. 5. During classes, do not be distracted and do not interfere with other students and the teacher. 6. Qualitatively fulfill the tasks of the SRO and submit it on time according to the schedule. 7. It is necessary to participate in all types of knowledge control (current control, passing SRO, intermediate control, final control).

Technical and electronic learning tools	<p>Atanasyan L.S., Bazylev V.T. Geometry. Ch.1,2, - M.: KNORUS, 2017. https://docplayer.ru/61450291-Ls-atanasyan-v-t-bazylevgeometriya-v-dvuh-chastyah.html</p> <p>S. L. Atanasyan, V. G. Pokrovsky, A. V. Ushakov. Geometry. Part 2. M., BINOM. Knowledge Lab.2015, 544 p, – ISBN 978-5-9963-0511-77. https://docplayer.ru/42228099-S-l-atanasyan-v-g-pokrovskiy-a-v-ushakov-geometriya-uchebnoe-posobie-dlya-vuzov.html</p>
Reading list	<p>Rashevsky P.K. Differential geometry. – M.: KNORUS, 2016 (in Russian),</p> <p>Werner A.L., Kantor B.E., Frangulov S.A. Geometry. Part 2., - St. Petersburg, 2015 (in Russian),</p> <p>Guseva N.I., Denisova N.S., Teslya O.Yu. Collection of problems in geometry. Part 1,2, - M.: KNORUS, 2016 (in Russian),</p> <p>Atanasyan L.S., Bazylev V.T. Geometry. Parts 1,2, - M.: KNORUS, 2017 (in Russian),</p> <p>S. L. Atanasyan, V. G. Pokrovsky, A. V. Ushakov. Geometry. Part 2. M., BINOM. Knowledge Lab, 2015, 544c, ISBN 978-5-9963-0511-7 (in Russian).</p> <p>Sharov G.S., Shelekhov A.M., Shestakova M.A. Differential geometry and topology in problems. –M.: Lenand, 2017 (in Russian).</p> <p>Tukanaev T. Workshop on solving problems of analytical and differential geometry. Textbook.-Almaty, ESPI, 2020 (in Kazakh).</p>

Module 33

Module code and name	MATH33026 Number theory and encryption algorithm									
Semester(s) when the Module is taught	7									
Lecturer	Kozybaev D.Kh.									
Credit points (total by discipline)	6 ECTS									
Teaching methods	Lectures, practices									
Workload (incl. contact hours, self-study hours)	<table> <tr> <td colspan="3">Total workload: 180</td> </tr> <tr> <td>Lectures</td> <td>Practical training</td> <td>Self-study hours</td> </tr> <tr> <td>30</td> <td>30</td> <td>120</td> </tr> </table>	Total workload: 180			Lectures	Practical training	Self-study hours	30	30	120
Total workload: 180										
Lectures	Practical training	Self-study hours								
30	30	120								
Required and recommended prerequisites for joining the Module	No									
Module objectives/intended learning outcomes	The objectives of studying the discipline: to acquaint students with the basic concepts, results and methods of number theory, to teach students to apply theoretical knowledge in solving problems, use them in practice, apply them in other mathematical disciplines and mathematical research; Mastering the basic methods and means of information protection.									

Content of the Module	Divisibility Theory. Prime and composite numbers. Arithmetic functions. Multiplicative functions and their properties. Möbius function. Euler function. The sum of divisors and the number of divisors of a natural number. Continuous fractions. Comparisons. Comparisons and their main properties. Deduction classes. Ring of residue classes for the given module. Euler's and Fermat's theorems. Comparisons with one unknown. Comparisons of the first degree. Chinese remainder theorem. Polynomial comparisons modulo prime. Polynomial comparisons modulo composite. Cryptographic means since ancient times. Basic concepts of cryptography. RSA algorithm.
Examination forms	Combined, in writing
Study and examination requirements	Attendance is compulsory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	AA Buchshtab Theory number (in Russian) https://catalog.enu.kz/enulib-web/public/portal/book/view/28851
Reading list	1. Sikorskaya G.A. Algebra and theory number: OGU; Omsk, 2017 (in Russian) 2. Danilova T.B. Theory number; Tasks with examples of solutions; textbook, SAFU, g. Arkhangelsk, 2015 (in Russian) 3. Орлов B. A., Medvedev N. V., Shimko N. A., Domracheva A. B. The theory was calculated in cryptography, MGTU. N.E. Bauman, 2011 (in Russian) 4. V.M. Sitnikov Theory number. Publishing House of Chelyabinsk State Pedagogical University, 2014 (in Russian) 5. Griбанov, V.U. Collection of exercises on the theory of numbers, Moscow, 1964 (in Russian) 6. Yu.V. Nestereno Textbook for students of higher educational institutions. - M.: Academy, 2008. - 272 p. - ISBN 978-5- 7695-4646-4 (in Russian)

Module 34

Module code and name	MATH23031 Projective geometry		
Semester(s) when the Module is taught	7		
Lecturer	Tukanayev T.D.		
Credit points (total by discipline)	6 ECTS		
Teaching methods	Lectures, practices, laboratory work, seminars, projects		
Workload (incl. contact hours, self-study hours)	Total workload: 180		
	Lectures	Practical training	Self-study hours
	30	30	120

Required and recommended prerequisites for joining the Module	Analytic geometry.
Module objectives/intended learning outcomes	To acquaint students with the basic concepts, results and methods of the theory of projective geometry, to teach students to apply theoretical knowledge in solving problems, to form their skills in research and teaching activities.
Content of the Module	Definition of the projective line. Projective coordinate system. Projective coordinates on the extended Euclidean line. Homogeneous affine coordinates. Definition of a dual relationship. Expression of projective coordinates in terms of double relations. Harmonic Fours. Double ratio on the extended Euclidean line. Perspective mapping of a plane into a bundle. Definition of the projective plane. Definition and assignment of projective coordinates. Coordinate transformation. The condition of collinearity of three points and the equation of a straight line. Line coordinates. Definition of affine homogeneous coordinates. Connection of homogeneous affine coordinates with non-homogeneous ones. Straight lines in homogeneous coordinates. Curves of the second order in homogeneous coordinates. Principle of duality. Desargues theorem. Inverse Desargues theorem. Expression of projective coordinates of points of the plane in terms of double ratios. Construction of harmonic quadruples on the extended Euclidean plane. Definition of a complete four-vertex. Harmonic properties of a complete four-vertex. Perspective mapping of a line to a line. Projective mapping of a line onto a line and its specification. The condition for the perspectiveness of a projective mapping. Equation of projective transformation of a straight line. Definition and sign of involution. Involution equation. Definition of a quadric. Reduction of the quadric equation to the canonical form. Projective classification of quadrics. Defining a quadric by five points. Tangents to a quadric. Definition of polars and poles. Properties of poles and polars.
Examination forms	Combined, written
Study and examination requirements	1. Obligatory attendance of classroom classes. If the student missed the lesson without good reason or was late, then this is taken into account when scoring; 2. When skipping classes for a good reason, the student, in agreement with the teacher, works out the topic of the missed lesson outside of school hours. 3. To receive points for a practical lesson, the student must actively participate in the lesson when discussing the topic, solving problems, and fully complete the tasks offered on the topic. 4. Prepare in advance for the lecture and practical task on the teaching aids recommended on this topic. 5. During classes, do not be distracted and do not interfere with other students and the teacher. 6. Qualitatively fulfill the tasks of the SRO and submit it on time according to the schedule. 7. It is necessary to participate in all types of knowledge control (current control, passing SRO, intermediate control, final control).

Technical and electronic learning tools	Atanasyan L.S., Bazylev V.T. Geometry. Parts 1, 2, - M.: KNORUS, 2017 (in Russian) https://docplayer.ru/61450291-Ls-atanasyan-v-t-bazylevgeometriya-v-dvuh-chastyah.html S. L. Atanasyan, V. G. Pokrovsky, A. V. Ushakov. Geometry. Part 2. M., BINOM. Knowledge Lab. 2015, 544c, ISBN 978-5-9963-0511-77. (in Russian) https://docplayer.ru/42228099-S-l-atanasyan-v-g-pokrovskiy-a-v-ushakov-geometriya-uchebnoe-posobie-dlya-vuzov.html
Reading list	Werner A.L., Kantor B.E., Frangulov S.A. Geometry. Part 2., - St. Petersburg, 2015 (in Russian), Guseva N.I., Denisova N.S., Teslya O.Yu. Collection of problems in geometry. Part 1,2, - M.: KNORUS, 2016 (in Russian), Atanasyan L.S., Bazylev V.T. Geometry. Parts 1,2, - M.: KNORUS, 2017 (in Russian), S. L. Atanasyan, V. G. Pokrovsky, A. V. Ushakov. Geometry. Part 2. M., BINOM. Knowledge Lab, 2015, 544c, ISBN 978-5-9963-0511-7 (in Russian). Pevzner S.L. Projective geometry. - M.: Enlightenment, 2012 (in Russian), Pevzner S.L. Tsalenko M.M. Taskbook-workshop on projective geometry. - M.: Enlightenment, 2013 (in Russian)

Module 35

Module code and name	COMP22007 Programming in C ++								
Semester(s) when the Module is taught	3								
Lecturer	Baydaulet A.T.								
Credit points (total by discipline)	5 ECTS								
Teaching methods	Classical, interactive, flipped classroom, student-centered, work with a textbook, peer learning, subgroup work, abstract, video teaching								
Workload (incl. contact hours, self-study hours)	Total workload: 150 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Lectures</th> <th style="width: 25%;">Practical training</th> <th style="width: 25%;">Lab</th> <th style="width: 25%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">105</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	15	15	15	105
Lectures	Practical training	Lab	Self-study hours						
15	15	15	105						
Required and recommended prerequisites for joining the Module	Algebra II, Analytic Geometry, Calculus II								
Module objectives/intended learning outcomes	Acquisition of knowledge about existing approaches in programming, as well as mastering the capabilities of the C ++ language with a concentration on solving object-oriented problems. Structured programming; algorithmization; OOP; work in the programming environment (creating, debugging and testing programs; developing and using interface objects) using C++.								

Content of the Module	<p><i>Procedural programming</i>: Structure of a C++ program; Using variables, declaring constants; Arrays and strings; Commands, expressions and operators;</p> <p>Branching of the program execution process; Organizing code with functions;</p> <p>Pointers and links;</p> <p><i>OOP</i>: Classes and objects; Implementation of inheritance; Polymorphism; Operator types and their overloading; Cast operators; Macros and templates;</p> <p><i>Introduction to the Standard Template Library (STL)</i>: STL string classes;</p> <p>Classes of dynamic arrays of the STL library; Classes of doubly linked and singly linked lists of the STL library.</p>
Examination forms	Combined
Study and examination requirements	<p>Mandatory attendance by students of all classes according to the schedule;</p> <p>Preliminary preparation for classes;</p> <p>Timely completion and submission of SROs;</p> <p>Preparation for all types of classes should be independent, creative;</p> <p>Active work and manifestation of creativity during classes;</p> <p>Participation in all types of control</p>
Technical and electronic learning tools	Personal computer, projector
Reading list	<ol style="list-style-type: none"> 1. Herbert Schildt: C++ basic Module. Moscow, 2016 (in Russian) 2. Kultin N.B. C/C++ in tasks and examples. - St. Petersburg: Peter, 2014 (in Russian) 3. Abramyana M.E. 1000 programming tasks Part I, II, III. Rostov-on-Don 2014 (in Russian) 4. Podbelsky V.V. C++ language. - Moscow: Finance and statistics, 2015.- 559p.: ill. (in Russian) 5. Podbelsky V.V. Workshop on programming in C++. - Moscow: Finance and statistics, 2014.- 574, p.: ill. (in Russian) 6. Laptev V.V. C++ object-oriented programming. - St. Petersburg: Leader, 2013. - 461 p. (in Russian)

Module 36

Module code and name	COMS22010 Numerical methods of analysis and algebra											
Semester(s) when the Module is taught	4											
Lecturer	Bukenov M.M.											
Credit points (total by discipline)	5 ECTS											
Teaching methods	Projects, classic, interactive, flipped classroom, work with a textbook, peer learning, subgroup work, abstract, video training											
Workload (incl. contact hours, self-study hours)	<p>Total workload: 150</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Lectures</th> <th style="text-align: left;">Practical training</th> <th style="text-align: left;">Lab</th> <th style="text-align: left;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">105</td> </tr> </tbody> </table>				Lectures	Practical training	Lab	Self-study hours	15	15	15	105
Lectures	Practical training	Lab	Self-study hours									
15	15	15	105									
Required and recommended prerequisites for joining the Module	Algebra II, Analytic Geometry, Calculus II											

Module objectives/intended learning outcomes	This discipline is aimed at teaching students the basic concepts and ideas of numerical methods of algebra and analysis, acquiring the skills to solve elliptic problems, using certain numerical methods to implement the simplest mathematical models on a computer.
Content of the Module	Approximate numbers and calculation errors. Algebraic and transcendental equations. Root separation methods. Numerical methods for solving nonlinear equations, Methods of chords, tangents and iteration. Finding the determinant and inverse matrix. Direct methods for solving algebraic systems of equations. Iterative methods for solving systems of linear equations. Eigenvectors and Matrix Eigenvalues. Statement of the interpolation problem. Interpolation formula of Lagrange. Newton's first and second interpolation formulas. Numerical differentiation. Graphic differentiation. Difference formulas. Formulas for integrating rectangles, trapezoid and Simpson. Numerical integration. Newton-Cotes quadrature formulas. Numerical methods for solving the Cauchy problem for ordinary differential equations. Euler method, modifications of the Euler method. Runge-Kutta methods. Boundary value problems of ordinary differential equations.
Examination forms	Combined
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Personal computer, projector
Reading list	1. Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical Methods: Textbook for High Schools. 2016 (in Russian) 2. Sobol B.V., Meskhi B.Ch., Peshkhoev I.M. Computational Mathematics Workshop, 2018 (in Russian) 3. Kopchenova N.V., Maron I.A., Computational mathematics in examples and problems, St. Petersburg, 2017 (in Russian) 4. Vorobieva G.N., Danilova A.N. Workshop on computational mathematics. - M.: Higher school, 2011 (in Russian) 5. Danilina N.I., Dubrovskaya N.S. Numerical methods. M. Higher School 2010 (in Russian)

Module 37

Module code and name	MATH33027 Linear programming and game theory
Semester(s) when the Module is taught	7
Lecturer	Zukhazhav A.
Credit points (total by discipline)	6 ECTS
Teaching methods	Lectures, practices, laboratory work, seminars, projects

Workload (incl. contact hours, self-study hours)	Total workload: 180 Lectures Practical training Lab Self-study hours 30 30 120
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics
Module objectives/intended learning outcomes	Mastering the necessary mathematical apparatus that helps to model, analyze and solve applied economic problems. Mastering the methodology for constructing and applying mathematical models of economic objects; deepening theoretical knowledge about the problems of the modern economy, investigated by means of mathematical modeling; mastering typical methods and models used in economic analysis, in making managerial decisions, in planning and forecasting, in various areas and levels of the economic mechanism.
Content of the Module	Geometric interpretation of non-linear programming (NP) problems. Classical methods for optimizing a function of many variables. Method of Lagrange multipliers. You are convex and concave functions. Necessary and sufficient conditions for the existence of a saddle point. The Kuhn-Tucker theorem. General statement of the problem of dynamic programming (DP). Bellman's principle of optimality. Algorithm of the DP method. Method of functional equations. The task of replacing equipment. Leontief model. Intersectoral balance of production (MOB) and distribution. Productivity and profitability of the economic-mathematical model of the MOB. The concept of multipurpose tasks.
Examination forms	Complex exam
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Interactive whiteboard, projector, practice cards
Reading list	1. Intrilligator M. Mathematical methods of optimization and economic theory, M.: Higher education, 2002 (in Russian). 2. Smirnov A.D. Lectures on microeconomic modeling. - M.: Higher School of Economics, 2000 (in Russian). 3. Malykhin V.I. Mathematical modeling of the economy. - M.: URAO, 1998 (in Russian). 4. Kolemaev V.A. Mathematical economics. - M.: UNITI, 1998 (in Russian)

Module 38

Module code and name	MATH33028 Applied methods of optimization
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Semester(s) when the Module is taught	7
Lecturer	Nurtazina K.B.
Credit points (total by discipline)	6 ECTS
Teaching methods	Lectures, practical exercises
Workload (incl. contact hours, self-study hours)	Total workload: 180 Lectures Practical training Lab Self-study hours 30 30 120
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics
Module objectives/intended learning outcomes	Studying the methods of linear and non-linear optimization (linear, convex, non-linear, integer, dynamic programming) and their practical implementation in problems arising in the theory of control, planning, as well as in solving various other problems related to the problem of decision making.
Content of the Module	Classification of optimization methods. The classical method of unconstrained optimization. Geometric interpretation of a linear programming problem; simplex algorithm. Transport problem. Integer programming. Nonlinear programming. Dynamic programming. Network tasks. Application of optimization methods: modeling the processes of distribution of resource flows. Simulation analysis of non-stationary parameters of the resource allocation problem. Optimal distribution and placement of equipment resources in production systems. Models of decision making in railway transport: computer analysis of decisions. Computer analysis of placement models for sensitivity. Expert system for solving optimization problems.
Examination forms	Oral
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Interactive whiteboard, laptop, slide presentations, Microsoft Teams, ZOOM.

Reading list	<p>1. Shukaev D.N. Applied optimization methods. - M.: Publishing house of the Academy of Natural Sciences, 2017. - 212 p. (in Russian)</p> <p>2. Thomas Y.H. Applied Optimization Methods for Wireless Networks. - Virginia Polytechnic Institute and State University, 2019. - 325 p.</p> <p>3. Jung Fa Tsai. Optimization Theory, Methods and Applications in Engineering. -- USA, 2020.</p> <p>Electronic resources: https://clck.ru/gfaGX https://clck.ru/gfaJf</p>
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Module 39

Module code and name	COMS 33029 Numerical methods for solving differential equations and the equations of mathematical physics								
Semester(s) when the Module is taught	7								
Lecturer	Tileubaev T.E.								
Credit points (total by discipline)	6 ECTS								
Teaching methods	Lectures, practical and laboratory work								
Workload (incl. contact hours, self-study hours)	<p>Total workload: 180</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Lectures</th> <th style="text-align: left;">Practical training</th> <th style="text-align: left;">Lab</th> <th style="text-align: left;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	30	15	15	120
Lectures	Practical training	Lab	Self-study hours						
30	15	15	120						
Required and recommended prerequisites for joining the Module	Differential equations, equations of mathematical physics, numerical methods of analysis and algebra								
Module objectives/intended learning outcomes	<p>Instilling the skills of modern types of mathematical thinking using computer technology.</p> <ul style="list-style-type: none"> - acquisition of theoretical and practical knowledge for solving problems by methods of computational mathematics, - instilling practical skills in the use of mathematical methods and the basics of mathematical modeling in practical activities using computers. 								

Content of the Module	Grids and grid functions. Difference approximation of the simplest differential operators. Approximation error on the grid. Statement of the difference problem. Increasing the order of convergence of a difference scheme. Cauchy problem. Integration of differential equations using series. Euler method. Modification of the Euler method. Explicit and implicit schemes. Runge-Kutta method. Method of the second order of accuracy (predictor-corrector). Adams method. Milne method. Stability of one-step and multi-step methods. Boundary Value Problems for Ordinary Differential Equations of the Second Order. Finite difference method for second order linear differential equations. Sweep method. Stability of the sweep method. Mesh method for parabolic equation. Explicit scheme calculation technique. Conditional stability. Difference methods for solving equations of hyperbolic type. Method of computations by implicit scheme. Absolute stability. Difference methods for solving equations of hyperbolic type. Method of computations by implicit scheme. Absolute stability. Difference methods for solving equations of elliptic type. Method of computations by implicit scheme. Absolute stability. splitting method. Sustainability. The order of approximations.
Examination forms	Combined
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Board, chalk, projector
Reading list	Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical methods. - M; St. Petersburg: Basic knowledge laboratory, 2012 (in Russian) Vorobieva G.N., Danilova A.N. Workshop on computational mathematics. - M.: Higher school, 2011 (in Russian). Kostomarov D.P., Korukhova L.S., Manzheley S.G. Programming and numerical methods. -M.: MSU Publishing House, 2010 (in Russian). Samarsky A.A., Gulin A.V. Numerical methods M., Nauka, 2007 (in Russian) Samarsky A.A. Nikolaev E.S. Methods for solving grid equations. Moscow, Nauka, 2011 (in Russian). Demidovich B. P., Maron I. A. Fundamentals of Computational Mathematics. - M.: Nauka, 2012 (in Russian).

Module 40

Module code and name	MATH22016 Modern foundations of the school Module of mathematics
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Semester(s) when the Module is taught	6
Lecturer	Zhuravleva O.I.
Credit points (total by discipline)	6 ECTS
Teaching methods	Lectures, practical exercises, abstract defense, fragments of lessons, business games
Workload (incl. contact hours, self-study hours)	Total workload: 180 Lectures Practical training Lab Self-study hours 30 30 120
Required and recommended prerequisites for joining the Module	To master this discipline, you need knowledge, skills and abilities acquired in the study of the following disciplines: elementary mathematics, pedagogy, psychology, didactics, history of mathematics, philosophy.
Module objectives/intended learning outcomes	Own the content of the school Module of mathematics, the methods of scientific knowledge used in mathematics; methods of teaching mathematics; mathematical concepts and methods of working with them. Be able to analyze various literature, including programs, textbooks, educational and methodological complexes and other teaching aids; select the necessary material; design the subject content of a lesson or any other type of lesson with students.
Content of the Module	Development of mathematics as a science; characteristics of mathematics as a science and as an academic subject; the main periods in the development of mathematics; characteristics of the methodology of mathematics. Training, education; educational, educational and developmental goals of teaching mathematics; the importance of the school mathematics Module in general education; development of mathematical thinking and mathematical abilities. The content of teaching mathematics in high school. Reforms in mathematics education; school structure, textbooks and organization of education after each reform; two main directions of reforming mathematical education in the world.
Examination forms	Combined
Study and examination requirements	Class attendance is mandatory. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Interactive whiteboard, laptop, slide presentations on selected topics, Microsoft Teams, ZOOM.

Reading list	<p>1. Methods and technology of teaching mathematics. A Module of lectures: a manual for universities. / Under the scientific. Ed. N.L. Stefanova, - M.: Bustard, 2005. Printed Electronic available (in Russian)</p> <p>2. Stolyar A.A. Pedagogy of mathematics. - Minsk: Higher school, - M.: Education., 2005. Printed Electronic available (in Russian)</p> <p>3. G.I. Sarantsev. Methods of teaching mathematics in high school: Proc. allowance for students mat. specialist. ped. universities and un-ov.-M.: Education, 2012. Electronic available (in Russian)</p> <p>4. Methods of teaching mathematics in high school. General methodology: textbook./Under the editorship of Yu.M. Kolyagin. Cheboksary, 2009. Electronic available (in Russian)</p>
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Module 41

Module code and name	TEEX22018 Pedagogical practic				
Semester(s) when the Module is taught	6				
Lecturer					
Credit points (total by discipline)	5 ECTS				
Teaching methods					
Workload (incl. contact hours, self-study hours)	<p>Total workload: 150</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Lectures</td> <td style="text-align: center;">Practical training</td> <td style="text-align: center;">Lab</td> <td style="text-align: center;">Self-study hours</td> </tr> </table>	Lectures	Practical training	Lab	Self-study hours
Lectures	Practical training	Lab	Self-study hours		
Required and recommended prerequisites for joining the Module	Algebra I, Mathematical Analysis I				
Module objectives/intended learning outcomes	<ul style="list-style-type: none"> - familiarization of interns with the functioning of the structures of the educational institution of preschool / secondary / secondary special education; - the formation of professional skills of pedagogical reflection and critical reflection on the pedagogical process necessary in future pedagogical activity; - application, interpretation and improvement of theoretical and practical knowledge acquired in the process of studying at the university; - formation of a creative research attitude to the professional activities of a teacher. 				

Content of the Module	<p>Fulfillment by student interns, leaders from the university and educational organizations of the duties provided for by the program of professional practice.</p> <p>In particular, student interns:</p> <ul style="list-style-type: none"> - perform all the tasks provided for by the program of professional practice and methodological recommendations, keep a diary-report of the practice on an ongoing basis, - obey the internal labor regulations in force in the educational institution, - study and strictly observe the rules of labor protection, safety and industrial sanitation, - participate in rationalization, inventive work and operational work on the instructions of the relevant departments, - carry out all the work specified in the approved Schedule for teaching practice, - daily attend practice and spend at least 11 hours a week on all activities (7 hours as a subject teacher and 4 hours as a class teacher), - keep records in a diary-report in order to use them to compile a report and fix important issues, - comply with ethical and moral standards in the Module of their professional activities, - at the end of the practice, they provide the head of practice from the university with a diary-report of the practice, a written report on the completion of all tasks, signed by the head from the school, - at the end of the practice, they defend the report to the members of the commission.
Examination forms	Protection of the report before the members of the commission
Study and examination requirements	Familiarization with the Professional Practice Program approved by the Pedagogical Practice Schedule. Participation in the launch conference. Carrying out all the work specified in the schedule of teaching practice together with leaders from the school and ENU. Preparation together with the leaders and submission of all necessary reporting documents (diary, reference from the leader, trainee report). Preparing a presentation and defending the report to the members of the commission.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	Professional practice program from 06/07/2019

Module 42

Module code and name	PHIS23019 Physics			
Semester(s) when the Module is taught	6			
Lecturer				
Credit points (total by discipline)	5 ECTS			
Teaching methods	Partial-exploratory, practical work, online, offline consulting			
Workload (incl. contact hours, self-study hours)	Total workload: 150			
	Lectures	Practical training	Lab	Self-study hours
	30	15		105

Required and recommended prerequisites for joining the Module	Mathematical Analysis II
Module objectives/intended learning outcomes	Have an idea about the strength, generality and correctness of physical laws. Possess knowledge of the basic physical phenomena and features of their Module, basic physical concepts, quantities, their mathematical expressions and units of measurement, basic principles, laws. To be able to carry out experimental studies of physical phenomena, to evaluate measurement errors, on the basis of physical laws to accurately and thoroughly argue the Module of reasoning, to solve problems for this module.
Content of the Module	Statistical physics and thermodynamics. Statistical distribution. Fundamentals of thermodynamics. transfer phenomenon. real gases. Electrostatics. Constant electric current. A magnetic field. The magnetic field of matter. The phenomenon of electromagnetic induction. Electromagnetic waves. Optics. The concept of ray (geometric) optics. Properties of light waves. Light interference. Diffraction of light. Propagation of light in matter. Thermal radiation.
Examination forms	A written exam
Study and examination requirements	Attending classroom classes, preliminary preparation for lectures and practical exercises, high-quality and timely completion of assignments, participation in all types of control (current control, SIW control, midterm control, final control)
Technical and electronic learning tools	Cards, lecture summary
Reading list	1. Saveliev I.V. Physics Module: Textbook in 3 volumes. – M.: Nauka, 1989 (in Russian). 2. Sivukhin D.V. General Module of physics. – M.: Nauka, 1977 (in Russian). 3. Detlaf A.A., Yavorsky B.M. Physics Module. – M.: VSh, 2000 (in Russian). 4. Landsberg G.S. Optics. – M.: Nauka, 1976. – 928 p. (in Russian)

Module 43

Module code and name	MECH23020 Theoretical Mechanics			
Semester(s) when the Module is taught	6			
Lecturer	1. Bostanov B.O. 2. Alimzhanov M.D.			
Credit points (total by discipline)	5 ECTS			
Teaching methods	Lectures, practices			
Workload (incl. contact hours, self-study hours)	Total workload: 150			
	Lectures	Practical training	Lab	Self-study hours
	30	15		105
Required and recommended prerequisites for joining the Module	Mathematical Analysis II			

Module objectives/intended learning outcomes	<p>Purpose: formation of knowledge among bachelors of the basic laws and equations of statics, kinematics and dynamics; ability to solve real problems of calculation of mechanical systems, using the methods of theoretical mechanics.</p> <p>Own the basic concepts and axioms of mechanics, methods for transforming systems of forces, conditions for the equality of a rigid body, methods for specifying the movement of a point and a body, the laws for determining the velocities and accelerations of points in a plane, spherical and arbitrary movement of a body and be able to apply them in solving practical problems of theoretical mechanics. To be able to consider natural phenomena in a schematic form, to bring specific problems to an abstract mechanical form, to compose and solve problems using appropriate methods.</p>
Content of the Module	Basic concepts and axioms of mechanics; ways to transform the system of forces; equilibrium conditions for a rigid body; ways to set the movement of a point and determine its speed and acceleration; basic types of motion of a rigid body; complex movement of a point; the main tasks of the dynamics of a material point; fundamentals of the dynamics of a mechanical system and the concept of general theorems
Examination forms	Combined
Study and examination requirements	Посещение аудиторных занятий, предварительная подготовка к лекциям и практическим занятиям, качественное и своевременное выполнение заданий, участие во всех видах контроля (текущий контроль, контроль СРО, рубежный контроль, итоговый контроль)
Technical and electronic learning tools	Tsyvilsky V.L. Theoretical mechanics (https://studref.com/496018/matematika_himiya_fizik/teoreticheska_ya_mehanika)
Reading list	<p>1. Alimzhanov M.D. Theoretical mechanics: a textbook for students of technical educational institutions. - Almaty: Evero, 2019. – 214 (in Russian).</p> <p>2. Meshchersky I.V. Collection of problems in theoretical mechanics: a textbook for students of higher technical educational institutions. - Ed. 36th, rev. - Moscow: Nauka, 1986. – 447 (in Russian).</p>

Module 44

Module code and name	MATH33021 Econometrics			
Semester(s) when the Module is taught	6			
Lecturer	Nauryzbayev N.Zh.			
Credit points (total by discipline)	5 ECTS			
Teaching methods	Explanatory and illustrative, reproductive, partially exploratory			
Workload (incl. contact hours, self-study hours)	Total workload: 150			
	Lectures	Practical training	Lab	Self-study hours
	15	15	15	105
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics			

Module objectives/intended learning outcomes	Be able to collect and analyze the initial data necessary to calculate economic and socio-economic indicators, formulate appropriate econometric models and perform the necessary calculations to determine the parameters of the model using the least squares method, assess the quality of the model using Fisher's F-criterion. Be able to use the results of econometric analysis to forecast and justify economic decisions.
Content of the Module	Paired linear regression and correlation. Building a multiple linear regression model. Statistical significance of the regression coefficients. Nonlinear econometric models. Extrapolation and forecasting in econometric studies. Fundamentals of financial mathematics. Deterministic constant annuities. Increasing and decreasing rents. Annuities paid with frequency p . Continuous rents. Profitability of investment projects. survival function. Macrocharacteristics of life expectancy. Analytical laws of mortality. The main characteristics of life expectancy.
Examination forms	Combined
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Laptop, projector, interactive whiteboard, MATLAB, MAPL software packages, individual cards
Reading list	<ol style="list-style-type: none"> 1. Babeshko L.O. Fundamentals of econometric modeling: textbook / L. O. Babeshko. - Ed. 4th. - M. : KomKniga, 2010. - 428 p (in Russian). 2. Dougherty K. Introduction to econometrics. – M.: INFRA-M, 2009 (in Russian). 3. Magnus Ya.R., Katyshev P.K., Peresetsky A.A. Econometrics. Initial Module. - M. : "Delo", 2004 (in Russian). 4. Workshop on econometrics: Textbook / Ed. Eliseeva. M.: Finance and statistics 2001 (in Russian). 5. Falin G.I., Falin A.I. An Introduction to the Mathematics of Finance and Investment for Actuaries: A Study Guide. – Ed. 2nd, revised. and add. - M. : MAKS Press, 2019 - 359 p. (in Russian)

Module 45

Module code and name	MATH33022 Applied problems of statistical analysis
Semester(s) when the Module is taught	6
Lecturer	Taugynbayeva G.E.
Credit points (total by discipline)	5 ECTS
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling

Workload (incl. contact hours, self-study hours)	<p>Total workload: 150</p> <table border="1" data-bbox="595 185 1487 293"> <thead> <tr> <th data-bbox="595 185 778 219">Lectures</th> <th data-bbox="786 185 1050 219">Practical training</th> <th data-bbox="1058 185 1257 219">Lab</th> <th data-bbox="1265 185 1487 219">Self-study hours</th> </tr> </thead> <tbody> <tr> <td data-bbox="595 248 778 282">15</td> <td data-bbox="786 248 1050 282">15</td> <td data-bbox="1058 248 1257 282">15</td> <td data-bbox="1265 248 1487 282">105</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	15	15	15	105
Lectures	Practical training	Lab	Self-study hours						
15	15	15	105						
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics								
Module objectives/intended learning outcomes	<p>Obtaining theoretical knowledge by students and acquiring practical skills in analyzing the economic and social processes of society. The tasks of mastering the discipline:</p> <ul style="list-style-type: none"> – mastering statistical methodology by students, which allows solving specific applied problems of economic and statistical analysis in various areas of economic activity and social relations (including using computer technology). – Increasing the general level of statistical culture of students, i.e. increasing the level of analytical and algorithmic thinking of students when conducting economic and statistical data analysis. – The ability to independently use statistical indicators and methods in the analysis in socio-economic studies. 								
Content of the Module	<p>Introduction to the discipline. The concept of Data mining as a multidisciplinary field. Data types. Data analysis tasks: classification, grouping, forecasting, finding associations and dependencies, visualization. The main sections on which data analysis is based: statistics, databases and knowledge, pattern recognition, artificial intelligence, machine learning. Classification of data analysis methods. Differences from SQL and OLAP technologies. Stages of data analysis: identifying patterns, forecasting, analysis of exceptions. Application areas of data analysis: finance and banking, marketing, medicine, genetics, bioinformatics, the Internet. Statistical methods of data analysis. Testing hypotheses about the probabilistic nature of the data (stationarity, normality, independence, homogeneity, estimation of the parameters of the distribution function). Identification of relationships and patterns in data (regression analysis, correlation analysis). Basic methods of multidimensional statistical analysis (discriminant analysis, cluster analysis, principal component analysis, factor analysis). Dynamic models and forecast based on time series. Cybernetic methods of data analysis. The concept of machine learning, artificial intelligence methods. Neural networks, their architecture (single-layer, multi-layer, with feedback). backpropagation method. Evolutionary and genetic algorithms. Data analysis methods based on the use of metrics: support vector machine, nearest neighbor method. decision trees. Methods for constructing decision trees. Decision tree quality criteria (Gini criterion, entropy and regularizing criteria). utility function. Basic operations with decision trees: branching, growth, reduction. The procedure for cross-checking the quality of a tree. Decision making based on a set of trees. Boosting method. Data mining tools. Data analysis in software systems Excel, Statistica.</p>								
Examination forms	Combined								

Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	Dyuk V. A., Samoylenko A. P. Data Mining: a training Module. SPb: Peter, 2001. Ayvazyan S.A. Mkhitaryan V.S. Applied Statistics and Fundamentals of Econometrics: Textbook. M., UNITI, 1998 (in Russian). Dubrov A.M. and et al. Multidimensional statistical methods for economists and managers. M.: FiS, 2000 (in Russian) Handbook of applied statistics / ed. Lloyd, Leaderman. T.2. - M.: Finance and Statistics, 1990 (in Russian).

Module 46

Module code and name	MATH33023 Financial and actuarial mathematics								
Semester(s) when the Module is taught	6								
Lecturer	Taugynbayeva G.E.								
Credit points (total by discipline)	5 ECTS								
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling								
Workload (incl. contact hours, self-study hours)	Total workload: 150 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Lectures</th> <th style="width: 25%;">Practical training</th> <th style="width: 25%;">Lab</th> <th style="width: 25%;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">105</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	15	15	15	105
Lectures	Practical training	Lab	Self-study hours						
15	15	15	105						
Required and recommended prerequisites for joining the Module	Theory of Probability and Mathematical Statistics								
Module objectives/intended learning outcomes	Own the theory of financial and actuarial mathematics, the theory of correlation and regression analysis; methods for studying quantitative patterns and qualitative statements (hypotheses) in micro- and macroeconomics and other industries based on the analysis of statistical data. Be able to carry out calculations related to the flow of payments; parameters of insurance schemes: risk premium, risk premium, gross premium necessary for the normal operation of insurance companies; determine the probability of an insurance company going bankrupt.								

Content of the Module	Compound and simple interest and interest rates, accumulation function, present value and discounting, yield estimation. Cost equation, time-weighted yield. Annuities: perpetual, unknown period and unknown interest rate, annuities with continuous interest, variable annuities. Depreciation and its schedule, sinking fund, rate of return. A bond, its price and amortization schedule. Mortality table, analytical formula, life expectancy, decrements. Insurance annuities with payments several times a year, variable insurance annuities. Life insurance, insurance at the time of death, with a variable sum insured, annual premiums and insurance reserves. Joint life insurance. Pension insurance.
Examination forms	Oral
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	<ol style="list-style-type: none"> 1. Michael Parmenter, The Theory of Interest, Life Insurance and Pension Insurance (translated from English), 2008, 315 pp. 2. A.G. Falin, G.I. Falin. An Introduction to the Mathematics of Finance and Investment for Actuaries: A Study Guide. – Ed. 2nd, revised. and add. - M.: MAKS Press, 2019 - 359 p. ISBN 978-5-317-06167-8 (in Russian) 3. G.I. Falin, A.I. Falin. Actuarial mathematics in tasks: Proc. manual on the Module "Mathematical models in life insurance", 1st edition: MAKS Press, Moscow, 2002. 134 p. ISBN 5-317-00412-8 (in Russian)

Module 47

Module code and name	MATH32017 Mathematical statistics								
Semester(s) when the Module is taught	5								
Lecturer	1. Zhubanysheva A.Zh.								
Credit points (total by discipline)	5 ECTS								
Teaching methods	explanatory and illustrative, reproductive, detailed evidence, work with educational literature, offline and online counseling								
Workload (incl. contact hours, self-study hours)	<p>Total workload: 150</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Lectures</th> <th style="text-align: left;">Practical training</th> <th style="text-align: left;">Lab</th> <th style="text-align: left;">Self-study hours</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">105</td> </tr> </tbody> </table>	Lectures	Practical training	Lab	Self-study hours	15	15	15	105
Lectures	Practical training	Lab	Self-study hours						
15	15	15	105						
Required and recommended prerequisites for joining the Module	Theory of functions of a real variable								

Module objectives/intended learning outcomes	Qualitative assimilation with knowledge of all definitions, motives for definitions and formulations of problems, formulations of theorems and their complete proofs, relevant counterexamples of probability theory and mathematical statistics and its role in natural science, applied orientation and orientation to the use of mathematical methods in solving applied problems.
Content of the Module	The main tasks of mathematical statistics: point estimates of distribution parameters (non-bias, consistency, efficiency in the class of estimates) and methods for finding them, interval estimates of unknown distribution parameters (construction of a confidence interval with a given probability), testing of statistical hypotheses (choice of two hypotheses: statistical criterion, critical set, error probabilities, significance level of the criterion, most powerful criterion, Neyman-Pearson test). Correlation analysis. Regression analysis. Applied aspects of probability theory and mathematical statistics.
Examination forms	Oral
Study and examination requirements	Class attendance is mandatory. In case of absence from the class without a valid reason and failure to complete the lecture notes, practical tasks, 0 points are assigned for the current rating of the week. The active participation of students is encouraged by additional points when setting the current rating. With a valid reason for absence from the exam, the student is allowed to retake the exam on the basis of the application submitted by him. In case of disagreement with the assessment for the exam, the student has the right to apply for a retake of the exam to the Appeals Commission in accordance with the established requirements.
Technical and electronic learning tools	Projector, presentations, Microsoft Teams platforms, ZOOM, electronic textbooks
Reading list	<ol style="list-style-type: none"> 1. Baldin, K.V. Theory of Probability and Mathematical Statistics. - Moscow: Dashkov and K, 2014. (in Russian) 2. DeGroot, Morris H. Probability and statistics / Morris H. DeGroot, Mark J. Schervish. 4th ed. 2012. 911 rubles 3. Fadeeva L.N. Probability theory and mathematical statistics. - Moscow: Eksmo, 2010. (in Russian) 4. Baldin, K.V. Theory of Probability and Mathematical Statistics. - Moscow: Dashkov and K, 2014. (in Russian) 5. Trofimova E.A., Kislyak N.V., Gilev D.V. Probability Theory and Mathematical Statistics: Proc. allowance / E.A. Trofimova, N.V. Kislyak, D.V. Gilev; [under common ed. E. A. Trofimova]; Ministry of Education and Science Ros. Federation, Ural. feder. university. - Yekaterinburg: Publishing House of Ural university, 2018. - 160 p. https://elar.urfu.ru/bitstream/10995/60280/1/978-5-7996-2317-3_2018.pdf?ysclid=l2jzx84eki (in Russian)

Module 48

Module code and name	EDIN22011Educational practice
Semester(s) when the Module is taught	4
Lecturer	Koshkarova B.S.
Credit points (total by discipline)	3

Teaching methods	explanatory and demonstration methods, laboratory works
Workload (incl. contact hours, self-study hours)	90 hours
Required and recommended prerequisites for joining the Module	Mathematical analysis II, Algebra, Numerical methods of analysis and algebra
Module objectives/intended learning outcomes	Learning the MatLab program for solving classical and modern problems of mathematics and the Latex text editor for introducing mathematical texts. Learning outcomes: - be able to develop an algorithm for solving typical problems of algebra and calculus in Matlab; - be able to develop algorithms for plotting 2 and 3 function graphs in Matlab; - be able to create a preamble for writing an article, report, presentation in LaTeX; - have knowledge of commands for typing mathematical formulas of varying complexity, for inserting pictures and photos into Latex.
Content of the Module	Matlab: Basic information. Introduction of real numbers, arrays. Operators in Matlab. Operations with vectors, matrices. Solution of typical problems of algebra and mathematical analysis. Programming in Matlab. Construction of graphs of functions. Latex: Structure of the text. Special symbols. Commands and methods of their introduction. A set of simple texts. Document rubrication. Creation of a bibliography and references. Mathematical formulas and their numbering. Introduction of drawings and photos. Creation of presentation and report. Complex mathematical formulas.
Examination forms	Report
Study and examination requirements	Timely completion of laboratory classes, filling out a practice diary, defending a report on the results of practice
Technical and electronic learning tools	Computer, presentations of lecture notes, guidelines for performing laboratory work, MATLAB and WINEDIT applications
Reading list	1. Kurbatova N.V., Pustovalova O.G. MatLab basics in examples and tasks. - Rostov-on-Don, 2017. (in Russian) 2. Lvovsky S. M. Typesetting and layout in the LATEX system. - M.: MTSNMO, 2014. - 400 p. (in Russian)

Module 49

Module code and name	ININ 42035 Industrial practice
Semester(s) when the Module is taught	8
Lecturer	Zhubanysheva A.Zh.
Credit points (total by discipline)	6
Teaching methods	practical tasks
Workload (incl. contact hours, self-study hours)	180 hours
Required and recommended prerequisites for joining the Module	

Module objectives/intended learning outcomes	Ability to prepare and monitor the plan of work, plan to do the work necessary resources, analytical approach to solving problems, work in a team and independently, acquire and use organizational and management skills, evaluate the results of their own work, to issue the results in the form of reports
Content of the Module	1) introduction to the work of the enterprise or organization where the student practical work, and perform tasks from the head of the practice of the enterprise; 2) the performance of tasks of the supervisor, aimed at selection of the subject area and topic of the future of final qualifying work. 3) Prepare a report on the implementation of industrial practice
Examination forms	Report
Study and examination requirements	the performance of all types of work, provided for the module, positive evaluation of the head of the practice, filling out a practice diary, defending a report on the results of practice
Technical and electronic learning tools	Computer, MATLAB, Exsel and WINEDIT applications
Reading list	The list of literature is selected depending on the base of practice

Module 50

Module code and name	RWEX42036 Pre – diploma practice
Semester(s) when the Module is taught	8
Lecturer	Zhubanysheva A.Zh.
Credit points (total by discipline)	6
Teaching methods	work with scientific literature, research methods
Workload (incl. contact hours, self-study hours)	180 hours
Required and recommended prerequisites for joining the Module	
Module objectives/intended learning outcomes	Ability to make a plan of work on certain sections of the thesis, to extract useful scientific and technical information from digital libraries, abstract journals, the Internet, an analytical approach to solving problems, present their own research results in the form of strictly warranted assertions execute research results in the form of articles , reports, etc.
Content of the Module	- A review of the scientific literature on the topic of the thesis; Drawing up a plan writing a thesis; - Justification of the relevance of the selected (offered) theme; - Analysis of the issue developed from the literature (monographs, research papers, reference books, textbooks, electronic publications, etc.); - Statement of purpose and the specific objectives of the study; - A description of the subject area; - Conducting research; - Preparation of graphic materials for the protection of the thesis.
Examination forms	Report
Study and examination requirements	timely completion of assignments for the thesis, writing and technical design of the thesis in accordance with the requirements, preliminary defense of the project

Technical and electronic learning tools	Computer, MATLAB, Exsel and WINEDIT applications
Reading list	the list of references depends on the subject of the study

Considered and approved at the meeting of the department of Fundamental Mathematics.
date 15.03. 2022 Record № 8

Alday M
(Name)


(signature)

(date)