

**NJSC «K.I. Satbayev Kazakh National Research Technical University»  
Institute of Information and Telecommunication Technologies  
School of Mathematics and Cybernetics**

**CURRICULUM PROGRAM**

**6B06103 - «Mathematical and computer modelling»  
Undergraduate education**

Based on invalidated classification of specialty:  
5B070500 – «Mathematical and Computer Modeling»

1-st edition  
in correspondence with the national standard of education of the Republic of Kazakhstan 2018

Almaty 2019

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| Разработано: | Рассмотрено: заседание УС<br>Института | Утверждено: УС КазННТУ | Страница 1 из 60 |
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The program is compiled and signed by

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Approved at the Session of Educational and Methodological Board of NJSC «K.I. Satbayev  
 Kazakh National Research Technical University».

Protocol №3 of 19.12.2018.

**Qualification:**

The 6B level of the informational and communicational technologies, «6B06»

**Professional competence:**

- ability to apply perspective methods for research and solution of professional problems on the base of world development trends of mathematics, computer engineering and information technologies;
- ability to develop conceptual and theoretical models for solving scientific problems and applied tasks;
- ability to plan scientific and research activity, to analyze risks, and to manage projects.

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## 1. Summary of the program

The aim of the educational program is to teach students general education, basic and specialized disciplines with the achievement of appropriate competencies.

The professional activity of the program's graduates is directed to the field of mathematical and computer modeling, namely the formulation of a mathematical task, the construction of a model and implementation through computer technologies.

Mathematics and computer modeling will be trained under the new Educational Program (OP) "Mathematical and Computer Modeling." The content of the disciplines of the educational programme will be developed in accordance with the relevant educational programs of the world's leading universities and the international classification of professional activities in the field of information technology.

In addition, the educational program "Mathematical and Computer Modeling" is developed on the basis of basic regulatory documents:

- The Education Act of 27.07.2007 No.319-III with changes and additions from 24.10.2011 No. 487-VI of the MISSILE System;
- Rules for the organization of the educational process on credit learning technology, approved by the Order of the Minister of THE Republic of Kazakhstan No. 152 of 20.04.2011 (the latest changes were made by the Order of the Minister of MON RK No.90 of 28.01.2016);
- State general standard of education at all levels of education, order No.604 of 31.10.2018.

National qualification framework. Approved by the protocol of March 16, 2016 by the Republican Tripartite Commission on Social Partnership and the Regulation of Social and Labor Relations;

- Model curriculum 6B06103 (old classifier: 5B070500) - "Mathematical and computer simulation" approved by the Order of the Minister of MON RK No.425 of 05.07.2016 (Annex 109).

The aim of creating a specialty is to train specialists in computer science and information technology in a huge mass of specialists who have valuable knowledge of the technologies of the future - artificial intelligence technologies that will distinguish them in the international IT-services market.

They will study the new methods of artificial intelligence on simple, "tangible" examples and the mathematical basis of machine learning and artificial intelligence. At the end of the course, graduates learn working machine learning algorithms to apply them in their tasks (theoretical or applied). If the full course of the bachelor's education program is successfully completed, the graduate is awarded a Bachelor's degree.

Training involves active research, participation in scientific projects led by leading experts in priority fields of science and practice, and cooperation with leading foreign organizations of education and science. Invited foreign professors (Germany, France, Slovenia, etc.) can lecture for students.

The BACHELOR's OP provides for the acquisition of the necessary competencies. In this regard, modern innovative disciplines have been introduced into the program.

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The educational program involves the mastery of fundamental SUN in mathematics and artificial intelligence. Graduates will have the opportunity to learn almost all the skills required in Data Science, Data Engineering, quantitative Analysis (in Python and R)languages and mathematics.

The program aims to implement the principles of the democratic nature of education management, expand the boundaries of academic freedom and the powers of educational institutions, which will provide training of qualified, highly motivated personnel for innovative and knowledge-intensive sectors of the economy.

The educational program ensures that the individual approach to learners is applied, the transformation of professional competencies from professional and qualification standards to learning outcomes. Student-centered learning is provided, the principle of education, which involves shifting emphasis in the educational process from teaching (as the main role of the teaching staff in the "broadcast" of knowledge) to teaching (as an active educational activity of the student).

The objectives and content of the OP can be found in Section 9 of the "Description of Disciplines."

If the full undergraduate degree is successfully completed, the graduate is awarded a bachelor's degree in informationandcommunication technology from theMathematical and Computer ModelingProgram.

## 2. Education program passport

**Name: Mathematical and computer modeling.**

**The purpose of the educational program:**

- Provide practice-oriented training for mathematical and computer modeling professionals
- Prepare graduates for production and technology activities related to the process of organization, design, security, database management, network technologies, cloud technologies, setting fundamental and targeted tasks, building mathematical models, implementing models with artificial intelligence and computer technologies
- To create the conditions for continuous professional self-improvement, development of social and personal competences of graduates (broad cultural outlook, active civic position, purposefulness, organization, diligence, sociability, ability to arguments and decision-making, knowledge of modern information technologies, fluency in several languages, desire for self-development and commitment to ethical values and healthy lifestyle, ability to work in a team, responsibility for the end result of their professional activities, civic responsibility, responsibility, social responsibility).

**The objectives of the educational program:**

- training a competitive generation of technical specialists in the field of mathematical and computer modeling for the labor market, proactive, able to work in a team with high personal and professional competences;

Integrating educational and scientific activities;

To establish partnerships with leading universities near and far abroad to improve the quality of education;

Expanding relationships with educational service customers, employers to determine quality requirements for training, courses, seminars, workshops, internships, and production practices. The content of the educational program "Mathematical and Computer Modeling" is implemented in accordance with the credit technology of training and is carried out in the state, Russian and English.

The educational program will allow the principles of the Bologna process to be implemented. Based on choice and self-planning by students последовательности изучения дисциплин, они самостоятельно формируют индивидуальный план обучения (ИУП) на каждый семестр согласно Рабочему учебному плану и КATALOGУ элективных дисциплин. В образовательной программе увеличен объем математических, естественно-научных, базовых и языковых дисциплин.

Students are practicing in banking structures, state and departmental structures, in companies such as Kazmunaigaz, the National Scientific Laboratory of Collective Use, Information and Space Technology, the Institute of Mathematics and Mathematical Modeling, Ozel Trade and Co.

**Level of education:** higher education

**NRK/ORC qualification levels:** covers basic 6 levels, but not limits.

**Occupation:** technical sciences and technology.

The bachelor's professional sphere is public and private enterprises and organizations that develop, implement and use organizational, hardware and software methods and in all areas of human activity operating critical information. The subjects of the bachelor's professional activity are: mathematical, informational and technical construction of models.

**Occupation:**

Design and design;

Manufacturing and technological;

Experimental research

Organizational and managerial;

Operational;

It's scientific.

**Objects of professional activity of bachelor's are:** organization and technology of building mathematical and computer models, optimization of various processes of life

**Features of the program:** academic exchange/credit system training/distance learning program

**Form of training:** full-time

**Terms of study:** 4 to 7 years.

**Languages of instruction:** Kazakh, Russian, English

**Credit/hours:** 278 loans

### 3. Requirements for incoming

Admission to the university, enrolled in the educational program "Mathematical and computer modeling" is carried out on the applications of the applicant, who completed in full secondary, medium-special education on a competitive basis in accordance with the points of the certificate issued on the results of a single national test with a minimum score - at least 65 points.

Special requirements for admission to the program apply to graduates of 12-year schools, colleges, programs of applied bachelor's degree, NIS, etc. Such applicants must pass diagnostic testing in English, mathematics, physics and special disciplines.

The rules for re-refosing loans for accelerated (reduced) education on the basis of 12-year secondary, secondary and higher education.

| Code   | Type Competence       | Description   | Result Competence   | Responsible -thful                                      |
|--|-----------------------|---|---|---|
| Shared<br>(Includes full training with possible additional, depending on the level of knowledge) |                       |   |   |   |
| G1   | In a communicative    | <ul style="list-style-type: none"> <li>- Fugitive monolingual oral, written and communication skills</li> <li>- the ability to communicate with a second language without fluent communication</li> <li>- the ability to use communicative communication in different situations</li> <li>- there are basics academic writing in their native language</li> <li>- diagnostic test for language level</li> </ul> | Full 4-year training with a minimum of 240 academic loans (of which 120 contact auditors Academic credits) with a possible renegotiation of loans in the second language where<br>The student has an advanced level. The level of language is determined by passing the diagnostic test | Department of Kazakh and Russian, Department of English |
| G2   | Mathematical Literacy | <ul style="list-style-type: none"> <li>- Basic mathematical thinking at the communication level</li> <li>- the ability to solve situational problems based on mathematical</li> </ul>   | Full 4-year training with a minimum of 240 academic loans (of which 120 contact auditors academic credits).   | Mathematics Department                                  |



|  |                                       |  |  |   |
|--|---------------------------------------|--|--|---|
|  |                                       | apparatus of algebra and began mathematical analysis<br>Diagnostic test for mathematical literacy in algebra   | If positive Test of the diagnostic test level Of Mathematics 1, with negative - the level of Algebra and the beginning of the analysis   |   |
| G3   | Basic literacy in science Disciplines | <ul style="list-style-type: none"> <li>- basic understanding of the scientific picture of the world with an understanding of the basic laws of science</li> <li>- understanding of basic hypotheses, laws, methods,</li> <li>- drawing conclusions and assessing errors</li> </ul> | Full 4-year training with a minimum of 240 academic loans (of which 120 contact auditors academic credits).<br>When positive surrender Diagnostic Test Level Physics 1, General Chemistry, At Negative - Level of Beginnings of Physics and Basic Chemistry Basics | Departments on the directions of the pits of natural sciences |
| <b>Specific</b><br>(includes reduced tuition by re-counting credits depending on the level of competence knowledge for graduates of 12-year schools, colleges, universities, including humanities and economics) |                                       |  |  |   |
| S1   | In a communicative                    | 1. Fugitive bilingual oral, written and communication skills<br>the ability to communicate with a third language without fluent communication  | Full re-repayment of credits by language (Kazakh and Russian)  | Department of Kazakh and Russian                              |



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|    |   | <ol style="list-style-type: none"> <li>1. writing skills of different styles and genres</li> <li>2. skills of deep understanding and interpretation of one's own work of a certain level of complexity (essay)<br/>basic aesthetic and theoretical literacy as a condition of full perception, interpretation original text</li> </ol>  |   |   |
| S2 | Mathematical Literacy   | <p>Special mathematical thinking using induction and deduction, generalization and specification, analysis and synthesis, classification and systemization, abstractions and analogies</p> <p>Ability formulate, substantiate and prove the provisions applying common mathematical concepts, formulas and extended spatial perception to mathematical problems full understanding of the basics of mathematical analysis</p> | Re-credit repayment<br>дисциплине<br>Математика<br>(Calculus) I   | Mathematics Department  |
| S3 | Special literacy in science (Physics, Chemistry, Biology and Geography) | <ol style="list-style-type: none"> <li>1. A broad scientific perception of the world that pre-whesively understands natural phenomena</li> <li>2. critical perception to understand the phenomena of the world around</li> <li>3. Cognitive abilities<br/>formulate a scientific understanding of the forms of existence of matter, its interaction in nature</li> </ol>  | Re-credits for Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Training practice, etc. | Departments on the directions of the pits of natural sciences |
| S4 | English language  | <ol style="list-style-type: none"> <li>1. ready for further English self-learning in various fields</li> <li>2. willingness to gain experience in design and Research<br/>working with English</li> </ol>   | Перезачет кредитов английского языка выше уровня академический до профессионального (до 15 кредитов)                                    | Кафедра английского языка                                     |

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| S5   | Computer skills                                  | 1. Basic programming skills on one modern Language<br>Using software and applications to teach different disciplines  | Re-credit for the discipline Introduction to information and communication technologies, Information and communication technologies   | Re-credit for the discipline Introduction to information and communication technologies, Information and communication technologies |
| S6   | Social and humanitarian competence and behaviour | - understanding and awareness of responsibility<br>- every citizen for the development of the country and the world<br>- the ability to discuss ethical and moral aspects in society, culture and science | Re-credit for Kazakhstan's Modern History (excluding state exam)  | Department of Public Disciplines  |
|  |  | Critical understanding and the capacity for polemics for<br>- debate on modern scientific hypotheses and theories   | Re-credit credits for philosophy and other humanitarian Disciplines   |   |
| PROFESSIONAL (implied reduced training by re-ingesting loans depending on the level of knowledge on competences for college graduates, AV schools, universities) |  |   |   |   |
| P1   | Professional competencies                        | - critical perception and a deep understanding of professional competencies at level 5 or 6<br>- the ability to discuss and debate professional issues as part of a mastered programme                    | Re-credit for basic professional disciplines, including introductions to the specialty, engineering ethics, robotic technology manufacturing, technological automation, the theoretical foundations of electrical engineering, technological measurements and instruments, the mathematical basis of management theory. | Releasing the pulpit  |

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| P2 | General engineering is competency     | <ul style="list-style-type: none"> <li>- basic general engineering</li> <li>- skills and knowledge, the ability to decide</li> <li>- general engineering tasks and problems</li> <li>- be able to use application packages to process experimental</li> <li>- data, solutions to algebraic and</li> <li>- differential equations</li> </ul> | Re-credit for general engineering Disciplines (engineering graphics, inlinemic geometry, the basics of electrical engineering, the basics of microelectronics.) | Releasing the pulpit |
| P3 | Engineering and computer competencies | <ul style="list-style-type: none"> <li>Basic skills to use computer programs and software to solve</li> <li>- general engineering tasks</li> </ul>  | Reload credits on computer graphics, computer modeling and programming MatLab.  | Releasing the pulpit |
| P4 | Socio-economic competence             | <ul style="list-style-type: none"> <li>- critical understanding and cognitive ability to reason on contemporary social and economic issues</li> <li>- basic understanding of the economic assessment of research sites and the profitability of projects.</li> </ul>  | Re-transfer credits for socio-humanitarian and technical and economic disciplines in the set-off of the electorate cycle  | Releasing the pulpit |

The university may refuse to re-book the loans if the low diagnostic level is confirmed or the final grades were lower than A and B.

#### 4. Requirements for completing your studies and getting a diploma

At the final stage of bachelor's preparation, the final state certification is provided in the form of state exams or(and) the performance and protection of the diploma project (work) depending on the specialty.

The academic disciplines, which provide for passing state exams and protecting the diploma project (work) are determined by the existing state general compulsory standards of higher vocational education.

The diploma project (work) is the result of independent research under the guidance of a scientific leader.

The protection of the diploma work and the passing of state exams are held at the meeting of the State Appraisal Commission.

The final state certification of students is carried out in accordance with the Rules of current monitoring of academic performance, intermediate and final state certification of students in educational organizations.

Those who have fully completed the curriculum on the educational and professional program of higher basic education, successfully passed the state exams or (and) defended the diploma project (work), are issued a diploma of higher education with qualifications and the award of an academic degree "Bachelor".

The graduate is also given an annex to the diploma, which includes the final examination and credit scores in the studied disciplines, the results of the state exams, the assessment on the protection of the diploma project (work) with the theme of the diploma project (work).

Persons who have completed their studies in the educational and professional programs of higher basic education may work on their qualifications or continue their studies on the relevant educational and professional programs of higher scientific and educational education in order to obtain a qualification and an academic degree "Bachelor".

- 4.1 Requirements for the key competencies of graduates:
- Have an idea:
  - about the major stages of development and paradigm shift in the evolution of science;
  - about the subject, worldview and methodological specifics of natural (social, humanities, economic) sciences;
  - about the scientific schools of the relevant field of knowledge, their theoretical and practical developments;
  - About scientific concepts of world and Kazakhstani science in the relevant field;
  - On the mechanism for introducing scientific developments into practical activities;
  - About the norms of interaction in the scientific community;
  - About the pedagogical and scientific ethics of a research scientist;

*know and understand:*

- modern trends, directions and regularities of the development of national science in the conditions of globalization and internationalization;
- Methodology of scientific cognition;
- Achievements of world and Kazakhstani science in the relevant field;
- (to realize and accept) the social responsibility of science and education;

- To perfect a foreign language for scientific communication and international cooperation;

*be able to:*

- Organize, plan and implement the research process;
- To analyze, evaluate and compare different theoretical concepts in the field of research and draw conclusions;
- Analyze and process information from a variety of sources.
- to conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;
- generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;
- Choose and use the current research methodology effectively.
- Plan and predict your future professional development.

*To have skills:*

- Critical analysis, evaluation and comparison of various scientific theories and ideas;
- Analytical and experimental scientific activities;
- Planning and predicting the results of the study
- oratorical arts and public speaking at international scientific forums, conferences and seminars;
- Scientific writing and scientific communication;
- Planning, coordinating and implementing research processes
- a systematic understanding of the field of study and demonstrate the quality and effectiveness of selected scientific methods;
- Participation in scientific events, fundamental scientific domestic and international projects;
- Leadership and team leadership;
- responsible and creative attitude to scientific and scientific and educational activities;
- patent search and experience in the transmission of scientific information using modern information and innovative technologies;
- Protecting intellectual property rights for scientific discoveries and developments;
- Free communication in a foreign language;

*Be competent:*

- in the field of scientific and scientific and educational activities in the face of rapid renewal and growth of information flows;
- Theoretical and experimental scientific research;
- In staging and solving theoretical and applied tasks in scientific research;
- To conduct a professional and comprehensive analysis of the problems in the relevant area;
- Interpersonal and human resource management;
- In matters of university training of specialists;
- Examination of scientific projects and research;
- to ensure continued professional growth.

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#### 4.2 Practice organization requirements:

The practice is carried out with the aim of developing practical skills of scientific and professional activity.

The undergraduate education program includes:

1) training (2 semesters);

2) производственную практику I (4 семестр), II (6 семестр).

The student's teaching practice is conducted in order to study the latest theoretical, methodological and technological achievements of domestic and foreign science.

Manufacturing practices are carried out in order to consolidate the theoretical knowledge gained during the training process and to improve the professional level.

## 5. The educational curriculum and the catalogue of elective disciplines

| Year of study   | 1 semester (Autumn 2019)                      |   |         |         |                |                | 2 semester (Spring 2020)          |                        |   |       |         |                |                |                |         |
|---|---|---|---------|---------|----------------|----------------|-----------------------------------|------------------------|---|-------|---------|----------------|----------------|----------------|---------|
|   | Code  | Name of discipline                                | Cycle   | Credits | lec/lab/pr/SIS | Code of retake | pre-requisites                    | Code                   | Name of discipline                                | Cycle | Credits | lec/lab/pr/SIS | Code of retake | pre-requisites |         |
| 1   | LNG 1051                                      | Beginner (A1)                                     | G       | 6       | 0/0/3/3        | S4             | test                              | LNG 1052               | Elementary English (A1)                           | G     | 6       | 0/0/3/3        | S4             | LNG 1051       |         |
|   | LNG 1052                                      | Elementary English (A1)                           |         |         |                |                |                                   | LNG 1052               |   |       |         |                |                |                |         |
|   | LNG 1053                                      | General English 1 (A2)                            |         |         |                |                |                                   | LNG 1053               |   |       |         |                |                |                |         |
|   | LNG 1054                                      | General English 2 (A2)                            |         |         |                |                |                                   | LNG 1054               |   |       |         |                |                |                |         |
|   | LNG 1055                                      | Academic English (B1)                             |         |         |                |                |                                   | LNG 1055               |   |       |         |                |                |                |         |
|   | LNG 1056                                      | Business English (B2)                             |         |         |                |                |                                   | LNG 1056               |   |       |         |                |                |                |         |
|   | LNG 1012                                      | Kazakh (Russian) language (A2)                    | G       | 4       | 0/0/2/2        | S1             | test                              | LNG 1012.1             | Academic Kazakh (Russian) language (B1)           | G     | 4       | 0/0/2/2        | S1             | LNG 1012       |         |
|   | LNG 1012.1                                    | Academic Kazakh (Russian) language (B1)           |         |         |                |                |                                   | LNG 1012.1             |   |       |         |                |                |                |         |
|   | LNG 1012.2                                    | Business Kazakh (Russian) language (B2)           |         |         |                |                |                                   | LNG 1012.2             |   |       |         |                |                |                |         |
|   | MAT 100                                       | Algebra and introduction to mathematical analysis | B       | 6       | 1/0/2/3        | S2             | test                              | MAT 101                | Mathematics I                                     | B     | 6       | 1/0/2/3        | no             | MAT 100        |         |
|   | MAT 101                                       | Mathematics I                                     |         |         |                |                |                                   | MAT 101                |   |       |         |                |                |                |         |
|   | PHY 110                                       | Introduction to Physics                           | B       | 6       | 1/1/1/3        | S3             | test                              | PHY 111                | Physics I   | B     | 6       | 1/1/1/3        | no             | PHY 110        |         |
|   | PHY 111                                       | Physics I   |         |         |                |                |                                   | PHY 111                |   |       |         |                |                |                |         |
|   | HUM 113                                       | The modern history of Kazakhstan                  | G       | 6       | 2/0/1/3        | S6             | no                                | CSE 155                | Algorithmization and programming basics           | B     | 6       | 1/1/1/3        | P1-3           | no             |         |
| MAT 113   | Discrete mathematics                          | MAT 137   |         |         |                |                |                                   | Abstract algebra       | MAT 124   |       |         |                |                |                |         |
| MAT 124   | Linear algebra and analytical geometry        | B   | 6       | 1/0/2/3 | no             | no             | <b>Total:</b>                     |                        |   |       |         |                |                |                |         |
|   |   |   |         |         |                | 40             | 40                                |                        |   |       |         |                |                |                |         |
| 2   | 3 semester (Autumn 2020)                      |   |         |         |                |                | 4 semester (Spring 2021)          |                        |   |       |         |                |                |                |         |
|   | LNG 1053                                      | General English 1 (A2)                            | G       | 6       | 0/0/3/3        | no             | LNG 1052                          | General English 2 (A2) | G   | 6     | 0/0/3/3 | no             | LNG 1053       |                |         |
|   | LNG 1054                                      | General English 2 (A2)                            |         |         |                |                | LNG 1053                          |                        |   |       |         |                |                |                |         |
|   | LNG 1055                                      | Academic English (B1)                             |         |         |                |                | LNG 1054                          |                        |   |       |         |                |                |                |         |
|   | LNG 1056                                      | Business English (B2)                             |         |         |                |                | LNG 1055                          |                        |   |       |         |                |                |                |         |
|   | LNG 1057                                      | Professional English (B2+)                        |         |         |                |                | LNG 1056                          |                        |   |       |         |                |                |                |         |
|   | MAT 102                                       | Mathematics II                                    |         |         |                |                | B                                 | 6                      |   |       |         |                | 1/0/2/3        | no             | MAT 101 |
|   | MAT 103                                       | Mathematics III                                   | MAT 102 |         |                |                |                                   |                        |   |       |         |                |                |                |         |
|   | CSE 174                                       | Information and Communications Technology (eng)   | G       | 6       | 2/0/1/3        | S5             | no                                | HUM 124                | Philosophy  | G     | 6       | 1/0/2/3        | S6             | no             |         |
|   | CSE 628                                       | Scientific Python                                 |         |         |                |                |                                   | MAT 128                | Theory of probability and mathematical statistics |       |         |                |                | MAT 101-103    |         |
|   | PHY 112                                       | Physics II  | B       | 6       | 1/1/1/3        | no             | PHY 111                           | MAT 140                | Differential geometry and topology                | B     | 6       | 1/0/2/3        | P1-3           | MAT 102        |         |
|   | 2212  | GEN101  |         |         |                |                | Engineering and computer graphics | no                     |   |       |         |                |                |                |         |
|   | CSE 164                                       | Algorithms and data structures                    | B       | 6       | 2/0/1/3        | P1-3           | CSE 155                           | <b>Total:</b>          |   |       |         |                |                |                |         |
|   |   |   |         |         |                |                | 36                                | 36                     |   |       |         |                |                |                |         |
| 3   | 5 semester (Autumn 2021)                      |   |         |         |                |                | 6 semester (Spring 2022)          |                        |   |       |         |                |                |                |         |
|   | MAT 126                                       | Ordinary differential equations. Matlab           | B       | 6       | 1/0/2/3        | no             | MAT 103                           | HUM126                 | Social & Political knowledge                      | G     | 8       | 4/0/0/4        | S6             | no             |         |
|   | MAT 127                                       | Partial differential equations. Matlab            |         |         |                |                | MAT 126                           |                        |   |       |         |                |                |                |         |
|   | AUT 146                                       | Automation basics                                 | B       | 6       | 1/0/2/3        | no             | PHY 111                           | MAT 127                | Partial differential equations. Matlab            | B     | 6       | 1/0/2/3        | no             | MAT 126        |         |
|   | MAT 141                                       | Optimization and control                          | S       | 6       | 1/0/2/3        | P1-3           | MAT 126                           | GEN128                 | Theoretical mechanics                             | S     | 6       | 1/0/2/3        | no             | MAT 126        |         |
|   | MAT139  | Theory of function of a real variable             | B       | 6       | 1/0/2/3        | P1-3           | MAT 102                           | MAT 144                | Equations of mathematical physics                 | S     | 6       | 1/0/2/3        | no             | MAT 127        |         |
|   | MAT 104                                       | Theory of a function of a complex variable        | B       | 6       | 1/0/2/3        | P1-3           | MAT 102                           | CSE 188                | The basics of artificial intelligence             | S     | 6       | 2/1/0/3        | no             | MAT 128        |         |
|   |   |   |         |         |                | 30             | 30                                |                        |   |       |         |                |                |                |         |
| 4   | 7 trimester (Autumn 2022)                     |   |         |         |                |                | 8 trimester (Spring 2023)         |                        |   |       |         |                |                |                |         |
|   | MAT 147                                       | Applied analysis                                  | S       | 6       | 1/0/2/3        | no             | MAT 127                           | 4309                   |   | S     | 6       |                | no             |                |         |
|   | MAT 237                                       | Machine learning methods                          | S       | 6       | 1/0/2/3        | no             | MAT 124, MAT 138                  | 4310                   |   | S     | 6       |                | no             |                |         |
|   | MAT 138                                       | Analysis on manifolds                             | S       | 6       | 1/0/2/3        | no             | MAT 102                           | 4311                   |   | S     | 6       |                | no             |                |         |
|   | MAT 142                                       | Functional analysis                               | S       | 6       | 1/0/2/3        | no             | MAT 102                           | ECA 101                | Preparation and writing of the thesis (project)   | FE    | 4       |                |                |                |         |
|   | ECA 101                                       | Preparation and writing of the thesis (project)   | FE      | 4       |                |                |                                   | ECA 102                | Defense of thesis (project)                       | FE    | 6       |                |                |                |         |
|   |   |   |         |         |                | 28             | 28                                |                        |   |       |         |                |                |                |         |
| <b>The number of credits for the entire period of study</b> |   |   |         |         |                |                |                                   |                        |   |       |         |                |                |                |         |
| Year of study   | Cycles of courses                             |   | Credits |         |                |                |                                   |                        |   |       |         |                |                |                |         |
|   |   |   | compu   | lab     | pr             | SIS            | electiv                           | a                      | Total   |       |         |                |                |                |         |
|   | Cycle of general courses (G)                  |   | 52      | 6       |                |                |                                   |                        | 58  |       |         |                |                |                |         |
|   | Cycle of basic courses (B)                    |   | 126     | 0       |                |                |                                   |                        | 126   |       |         |                |                |                |         |
|   | Cycle of courses in the specialty profile (S) |   | 48      | 18      |                |                |                                   |                        | 66  |       |         |                |                |                |         |
|   | <b>Total of theoretical course:</b>           |   |         | 226     | 24             |                |                                   |                        | 250   |       |         |                |                |                |         |
|   | Extra education                               |   | 12      | 2       |                |                |                                   |                        | 14  |       |         |                |                |                |         |
| Final examination (FE)                                      |   | 14  | 0       |         |                |                |                                   | 14                     |   |       |         |                |                |                |         |
| <b>Total:</b>   |   |   | 26      | 2       |                |                |                                   | 28                     |   |       |         |                |                |                |         |
| <b>Classroom volume of credits of theoretical course:</b>   |   |   | 252     | 26      |                |                |                                   | 278                    |   |       |         |                |                |                |         |

Разработано:

Рассмотрено: заседание УС  
Института

Утверждено: УС КазНИТУ

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## Catalogue of elective disciplines

| Year of study      | Code of electives for educational program | Code of courses | Name of courses  | Cycle | ECTS | Credits | lec/lab/pr | pre-requisites   |
|--------------------|---|-----------------|--|-------|------|---------|------------|------------------|
| <b>2 semester</b>  |   |                 |  |       |      |         |            |                  |
| 1                  | 1106                                      | LNG103          | Culture of business communication (C1)                               | G     | 4    | 2       | 0/0/2      | LNG 1012.2       |
|                    |   | LNG102          | Rhetoric (C1)  |       |      |         |            |                  |
|                    |   | LNG1161         | Professional Kazakh language (C1)                                    |       |      |         |            |                  |
|                    |   | LNG1161         | Professional Russian (C1)  |       |      |         |            |                  |
| <b>Total:</b>      |   |                 |  |       | 4    | 2       |            |                  |
| <b>3 semester</b>  |   |                 |  |       |      |         |            |                  |
| 2                  | 2212                                      | GEN119          | Fluid and gas mechanics  | B     | 6    | 3       | 2/0/1      | no prerequisites |
|                    |   | CHE192          | General Chemistry  |       |      |         | 1/1/1      |                  |
| <b>Total:</b>      |   |                 |  |       | 6    | 3       |            |                  |
| <b>4 semester</b>  |   |                 |  |       |      |         |            |                  |
| 2                  | 2110                                      | LNG109          | IELTS Preparation  | G     | 6    | 3       | 0/0/3      | LNG 1056         |
|                    |   | LNG110          | Intercultural Communication  |       |      |         |            |                  |
|                    |   | LNG117          | Technical Writing  |       |      |         |            |                  |
|                    |   | LNG118          | Public speaking  |       |      |         |            |                  |
|                    |   | LNG119          | Productivity skills  |       |      |         |            |                  |
|                    |   | LNG120          | GRE preparation  |       |      |         |            |                  |
| <b>Total:</b>      |   |                 |  |       | 6    | 3       |            |                  |
| <b>5 semester</b>  |   |                 |  |       |      |         |            |                  |
| <b>6 semester</b>  |   |                 |  |       |      |         |            |                  |
| 3                  | 3222                                      | MAT161          | Mathematical statistics and stochastic processes                     | B     | 6    | 3       | 2/0/1      | MAT 103          |
|                    |   | MAT150          | Mathematical models of traffic flows                                 |       |      |         | 2/0/1      | MAT 141          |
|                    |   | MAT145          | Variational calculus and optimal control                             |       |      |         | 2/0/1      | MAT 141          |
|                    |   | MAT148          | Introduction to Financial Mathematics                                |       |      |         | 2/0/1      | MAT 103          |
|                    |   | CBI104          | General Chemistry II   |       |      |         | 1/1/1      | CBI102           |
| <b>Total:</b>      |   |                 |  |       | 6    | 3       |            |                  |
| <b>7 trimester</b> |   |                 |  |       |      |         |            |                  |
| <b>8 trimester</b> |   |                 |  |       |      |         |            |                  |
| 4                  | 4309                                      | CSE439          | Data analysis  | S     | 6    | 3       | 2/1/0      | MAT 103          |
|                    |   | MAT155          | Machine Learning and Data Mining                                     |       |      |         | 2/0/1      | MAT 103          |
|                    |   | MAT233          | Artificial Neural Networks   |       |      |         | 2/0/1      | CSE 155          |
|                    |   | CSE189          | Concurrent programming   |       |      |         | 2/1/0      | CSE 155          |
|                    |   | CSE651          | Natural Language Processing  |       |      |         | 2/1/0      | CSE 155          |
|                    |   | MAT152          | Asymptotic expansions and averaging                                  |       |      |         | 2/0/1      | MAT 126          |
|                    | 4310                                      | CSE617          | Information theory   | S     | 6    | 3       | 2/0/1      | MAT 103          |
|                    |   | CSE298          | Python I data processing   |       |      |         | 2/0/1      | CSE628           |
|                    |   | MAT156          | Advanced Machine Learning Algorithms                                 |       |      |         | 2/0/1      | MAT 103          |
|                    |   | CSE650          | Digital Image Processing   |       |      |         | 2/0/1      | CSE 155          |
|                    | 4311                                      | MAT153          | Stratified Set Analysis  | S     | 6    | 3       | 2/0/1      | MAT 102          |
|                    |   | CSE626          | Database   |       |      |         | 2/0/1      | MAT 103          |
|                    |   | CSE639          | Functional programming (R language in statistical analysis problems) |       |      |         | 2/0/1      | CSE 155          |
|                    |   | MAT160          | Computer Architecture & Concurrency                                  |       |      |         | 2/0/1      | CSE 155          |
|                    |   | MAT151          | Riemannian geometry  |       |      |         | 2/0/1      | MAT 140          |
| MAT159             | Adaptive Traffic Control                  | 2/0/1           | MAT 141  |       |      |         |            |                  |
| <b>Total:</b>      |   |                 |  |       | 18   | 9       |            |                  |

## 6. Descriptors of level and scope of knowledge, skills, skills and competencies

In the process of mastering the educational program, the Bachelor of Technology and Technology must have the following key competencies.

A - knowledge and understanding:

A1 are scientific principles based on the study of general professional and special disciplines, containing both basic and in-depth courses for fundamental training in mathematical and computer modeling.

A2 - organizations of computing systems; Designing digital devices Application of languages and programming technologies knowledge of the mathematicalbasics.

A3 - system analysis methodology; Designing and making decisions in complex and professional situations Ways to communicate and reconcile points of view; design and presentation of analytical and project documentation.

In the application of knowledge and understanding:

B1 - to analyze the subject area, identify goals and how to achieve them;

B2 - for self-development and nomination of various options for solving professional problems using theoretical and practical knowledge;

B3 - to build mathematical models with real-world

Conditions to optimize different processes.

C - the formation of judgments:

C1 - about current trends in mathematical and computer modeling;

C2 - about modern approaches in mathematical modeling with the use of artificial intelligence to solve fundamental and production problems,while being able to compare, shape conclusions, build their own reasoning, express and justify their position;

D - personal abilities:

D1 - awareness of the social importance of the profession, adherence to the principles of professional ethics, improving the professional and personal qualities of a specialist in the field of mathematical and computer modeling;

D2 - the desire to develop intellectual, moral, communicative, organizational and management skills;

D3 - the ability to listen, convince and argue, the ability to find a compromise, to correlate their opinion with the team, the ability of public professionally -oriented communication;

D4 - the ability to organize the collection, storage and processing of information used in the field of professional activity, in global computer systems, networks, library funds and other sources of information.

|              |  |                        |                   |
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## 7. Competence at the end of training

| <b>Competence profile</b>  |   |
|--|---|
| <p><b>The purpose of the training:</b> Specialists in this educational program should be able to analyze the object under study, formulate a mathematical model, use a mathematical apparatus to solve a problem, optimally use computing technology, develop databases, program. The theoretical and practical basis of mathematical modeling of physical, natural, medical, chemical, biological processes, high-level programming languages, visual programming languages, modeling languages, computing, system administration, computer networks, operating systems, applications of custom purposes, specialized programs should be known. Must have the skills to create mathematical models, solve mathematical problems, develop and implement a database, programming.</p> | <p>Work in the scientific and educational field, training specialists in mathematical and computer modeling and artificial intelligence; Professional activities in the field of computer programming;</p> <p>Research, technical testing and analysis, natural science and engineering pilots;</p> <p>General public administration work;</p> <p>Management activities of parent companies, other professional, scientific and technical activities in the field of engineering research and providing technical advice in this area;</p> <p>Specialist, lead specialist, lead engineer, software engineer in organizational and management organizations;</p> <p style="text-align: center;">- Research fellow</p> <p>-in research organizations as a researcher, lead engineer or mathematician-programmer as a developer of mathematical models of physical and chemical and technological processes;</p> <p>-in design organizations as a developer of mathematical and computer models, mathematician-programmer;</p> <p>-in organizational and technological organizations as a mathematician, mathematician-programmer, developer of mathematical and computer models or computer scientist;</p> <p>-in production and management organizations as a mathematician-programmer and computer scientist.</p> |
| <p><b>The name of the section, the section of the ORC, the State general standard of higher education</b></p>  | <p>Information and communication technologies</p>   |

|                                      |  |
|--------------------------------------|--|
| <b>Competence (labour functions)</b> | <p style="text-align: center;">Technology Specialist      Education<br/>Program</p> <p>"Mathematical and computer simulations" can work in the direction of:</p> <ol style="list-style-type: none"> <li>1. Task engineer and process modeling engineer</li> <li>2. System Administrator</li> <li>3. Software development specialist</li> <li>4. Database Analyst</li> <li>5. Researcher</li> </ol> <p>- Heads of service in the field of information and communication technologies.</p> |
|--------------------------------------|--|

| <b>List of competencies in the section of academic degree</b> |   |  |
|---|---|--|
| <b>Code Competence</b>  | <b>Competence</b>   |  |
| <b>Common competencies</b>                                    |   |  |
| OK1   | Owning knowledge of the historical, cultural and scientific achievements of the Republic of Kazakhstan; Use historical sources and special literature; analyze and evaluate historical facts and events |  |
| OK2   | Possession of a broad social and social, political and professional outlook   |  |

|                           |  |  |
|---------------------------|--|--|
| OK3                       | Have an idea of the subject, functions, main sections and directions of philosophy; place and the role of philosophy in the life of society and man, apply knowledge of philosophical and methodological principles of cognition in professional activities  |  |
| OK4                       | Logically, to own method induction and deductions, to determine cause-investigative relations; to master the methods of decomposition, analysis and synthesis of systems   |  |
| OK5                       | Possession of Kazakh, Russian, foreign languages. The ability to work with scientific and technical literature in Kazakh, Russian and foreign languages; Produce Search for scientific and technical information; understand the information provided at a normal pace, with the subsequent transmission of its contents To conduct intercultural dialogue, to develop and deepen their knowledge, to be open to new information; Establish professional contacts and develop professional communication in a foreign language; Doing business in a foreign language; know terminology, read literature by specialty in a foreign language |  |
| OK6                       | Plan the stages of scientific research, organize search and select relevant information  |  |
| OK7                       | Structure and edit information, prepare technical and scientific documentation in accordance with Existing requirements  |  |
| OK8                       | The ability to reason and clearly build an oral and written speech, to explain your view of the problem.   |  |
| OK 9                      | The ability to analyze, model, design, to introduce, to evaluate information and communication technology systems.   |  |
| <b>Basic competencies</b> |  |  |
| БК1                       | To use fundamental concepts of mathematics in professional activities; to prove mathematical statements, to solve mathematical problems and problems, to identify their essence, to translate into mathematical language problems set in terms of other subject areas in particular IT technologies; to set mathematical problems; to build mathematical models; to select suitable Mathematical methods and problem-solving algorithms to conduct qualitative mathematical research.  |  |
| БК2                       | Apply basic methods of formalization of reasoning, basic concepts of theory of logical functions, algorithm theory, graph theory, coding theory; use the conceptual apparatus and discrete mathematics techniques to analyze mathematical  |  |

|  |   |  |
|--|---|--|
|  | models in the work of professional activities.  |  |
| БК3  | Apply theoretical knowledge to solve generalized typical physical problems in mechanics, molecular physics and thermodynamics, electricity; Conduct a physical experiment; calculate, analyze and process physical results<br>Experiment.     |  |
| БК4  | Choose elements of electronic circuits, make the necessary calculations, make a mathematical description of the functioning of devices and determine their characteristics; determine the parameters<br>semiconductor devices and schematics. |  |
| БК5  | To formulate technical requirements based on the functions performed by computing systems; Justify architecture identify tools to measure system performance.   |  |
| БК6  | Use methods of building different models of data types, algorithms for processing information; to make good use of the opportunities offered<br>algorithmization technique, to solve practical problems.                                      |  |
| БК7  | Use a unified modeling language, implement a structural and object-oriented approach in toolwork.   |  |
| БК8  | Apply professional, managerial and communication skills acquired in the study of discipline, namely, to practically apply the principles<br>build operating systems and keep them safe.   |  |
| <b>Professional competencies</b>           |   |  |
| ПК1  | Apply database technology to securely organize, obtain, store, recycle and transfer of information.   |  |
| ПК2  | Ensure the integrity and reliability of data in databases<br>perceptions, triggers. Reserve, restore, monitor, and audit database systems.  |  |
| ПК3  | Be able to build mathematical models based on existing data and be able to recover data using statistical methods.  |  |
| ПК4  | The ability to apply modern information technology in standardization and certification systems.  |  |
| ПК5  | The ability to use artificial intelligence to solve optimization problems.  |  |
| <b>Special and management competencies</b> |   |  |
| СК 1                                       | The ability to lead the design process and organize mathematical and computer models.   |  |

|      |  |  |
|------|--|--|
| СК 2 | Applying theoretical knowledge to develop and present your own conclusions in solving production problems in the field of IT and mathematical modeling. The ability to make decisions in complex and non-standard situations in the organization and management of the company's activities. |  |
|------|--|--|

B - Basic knowledge, skills and skills:

B1- to be able to analyze the current problems of the modern history of Kazakhstan;

B2 - to know and apply in practice the basics of engineering professional Ethics

B3 - to know the modern and promising directions of information technology development and mathematical methods of optimization.

P - Professional competencies, including in accordance with the requirements of industry professional standards:

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 - the ability to organize, provide, design mathematical models and implement them with the help of artificial intelligence and information technology.

A - Human, social and ethical competences:

A1 - the ability to constantly learn, to focus; Be confident in uncertainty. Have a high level of spatial and logical thinking;

A2 - the ability to work in a team, to have organizational skills, to prioritize, to quickly learn new knowledge and skills, to apply them in practice;

A3 - to be results-oriented, to plan effectively and organize one's development;

A4 - the ability to freely use English as a means of business communication, a source of new knowledge in the field of mathematical and computer modeling.

S - Special and management competencies:

S1 - self-management and control of work and training processes within the framework of the organization's strategy, policy and objectives, critical discussion of the problem, reasoning conclusions and competent operation of information;

S2 - the ability to motivate to solve certain problems, the ability to be responsible for the result of work at the level of a unit or enterprise;

S3 - the ability to demonstrate a set of work management skills, the ability to choose methods, techniques and evaluation criteria to obtain results, distribute and delegate authority, form teams, and make decisions during the production process.



## 8. Appendix to the standard diploma ECTS

ECTS – European Credit Transfer and Accumulation System (European system of translation and scoring accumulation) is a pan-European system for taking into account the academic work of students when mastering an educational program or course. In practice, the ECTS system is used in the transition of students from one educational institution to another throughout the European Union and others who have adopted this system, European countries, including the Republic of Kazakhstan.

To get a bachelor's degree you need to get 240 in academic credits.

The app consists of 8 obligatory items in English/Kazakh/Russian languages. It is a standardized text that confirms that the application is compliant with European standards. The form of the European diploma application is shown in Annex A.

Section 1 Information about the qualification holder: the name, name (as recorded in the passport), date and place of birth, identification number or student code are specified.

Section 2 Information on the qualification received: qualification name, major specialty, additional minor specialty (if available), name and status of a higher education institution, which assigned qualifications in the native language, the name and status of a higher education institution, the qualification in English, the language of instruction and control of knowledge.

Section 3 Information on the level of qualification: indicates the level of qualification - bachelor's degree (master's degree, doctorate), duration of study, requirements for admission.

Section 4 Information on the content of the training and the results: the form of education is specified - full, remote, abbreviated full, the requirement of the program (the required volume for the mastery of the program), the content of the educational program (mandatory and elective disciplines, student coursework, completed practices, protected diploma work indicating the laboriousness of disciplines, practices, coursework and diplomas, status (mandatory, by choice, additional), final assessments) in loans of RK and ECTS, national assessment scale approved by the order of MONRC and its description, the mechanism of transfer of assessments to the European system, general classification of qualifications.

Section 5 Professional qualifications: whether the qualifications are available to advance to the next stage of education and what requirements to do so must be met, professional status (which professional rights are acquired by students with qualifications).

Section 6 Additional information: additional information about the university, additional sources of information.

Section 7 App Certification: specified the date of qualification, the date of issuance, the name, the name of the official certifying the application to the diploma, signing the diploma itself; all of this information is sealed.

Section 8 Information on the National Higher Education System.

This application is issued only at the end of the university on the application of the graduate on a remunerative basis in accordance with the standards set by the university.

To receive the application, you must submit a written (electronic) application to the university office with an application copy of the receipt.

The application is issued by the Office registrar within 15 business days of application and is registered in the journal of issuance and registration of diplomas and applications. Application form forms are stored in the Registrar's Office.

## 9. List of modules and learning results

OP - Mathematical and computer simulation

Skills: Bachelor of Information and Communication Technology in Mathematical and Computer Modeling

| Module name                            | Learning results<br>(in accordance with professional tasks)  | Evaluation criteria<br>Learning results                     | Disciplines that<br>form the module          |
|--|--|---|--|
| <b>General education modules (OOM)</b> |  |   |  |
| <b>OOM1 Social<br/>Science Module</b>  | <p><b>Has an</b> idea of individual phenomena and events of the historical past with a common paradigm of the world-historical development of human society</p> <p><b>Capable</b> of thinking objectively and comprehensively inherent advantages, features and importance of Kazakhstan's development model</p>   | Oral survey, testing, report, border control, semester work | <b>OM1.1.</b><br>Kazakhstan's Modern History |
|  | <p><b>Has an</b> idea of the subject matter, functions, main sections and directions of philosophy; the place and role of philosophy in the life of society and man; the main stages of the development of world and Kazakh philosophical thought;</p> <p><b>It is able</b> to determine correct and incorrect forms of reasoning; to analyze the meaning and forms of knowledge; to own methods of decomposition of systems and objects, analysis and synthesis of complex systems.</p> | Oral survey, testing, report, border control, semester work | <b>DOM1.2.</b><br>Philosophy                 |

|                                      |  |   |  |
|--------------------------------------|--|---|--|
| <b>OOM2 Language Training Module</b> | <p><b>He is able</b> to conduct a dialogue in a foreign language, using the rules of speech etiquette; establish professional contacts and develop professional communication in a foreign language; receive information from the media, listen and analyze news and reports about current events; conduct interviews, clarify and confirm information, developing the most interesting points; explain your point of view on the current issue, expressing all the arguments</p> <p>For and against, to defend their position during debates, to debate; to present one's point in writing, withstanding the structure of the written response; write business letters, annotations, detailed messages on a given topic, reports, analyze graphs, summarize the main idea of articles or Texts.</p> | Oral survey, testing, report, border control, semester work | <p><b>ДОМ2.1.</b><br/>Foreign language</p> <p>Beginner (A1)<br/>Elementary English (A1)<br/>General English 1 (A2)<br/>General English 2 (A2)<br/>Academic English (B1)<br/>Business English (B2)<br/>Professional English (B2+)</p> |
|                                      | <p><b>He is able</b> to conduct a dialogue in the Kazakh language, using the rules of speech etiquette; establish professional contacts and develop professional communication in the Kazakh language; receive information from the media, listen and analyze news and reports about current events; conduct interviews, clarify and confirm information, developing the most interesting moments;</p>   | Oral survey, testing, report, border control, semester work | <p><b>ОМ2.2.</b><br/>Kazakh (Russian) language</p> <p>Kazakh (Russian) (A2)<br/>Academic Kazakh (Russian) language (B1)<br/>Business Kazakh (Russian) language (B2)</p>  |

|  |  |  |   |
|--|--|--|---|
|  | <p>explain your point of view on the current issue, expressing all the arguments for and against, defending their</p> <p>Position during debates, debate; to present one's point in writing, withstanding the structure of the written response; to compile business letters, annotations, detailed messages on a given topic, reports, analyze graphs, summarize the basic idea of articles or texts.</p>   |  |   |
| <p><b>OOM3 Information and Communication Technology Module</b></p> | <p>Has an idea of the computer's device; The architecture of computing systems</p> <p>Infrastructure information and communication technologies;</p> <p>About the interface of modern operating systems</p> <p>About threats to information security, principles, tools, and data protection practices.</p> <p><b>It is able</b> to work with interfaces of modern operating systems and applied software to apply modern social, cloud, mail platforms to organize business processes;</p> <p>Programming in an algorithmic programming language to analyze, model, design, implement, test and evaluate information and communication systems</p> <p>Technologies.</p> | <p>Oral survey, testing, report, border control, semester work</p> | <p><b>OM2.3.</b><br/>Information and communication technologies</p> |
| <p><b>Basic modules (BM)</b></p>                                   |  |  |   |

|  |  |   |   |
|--|--|---|---|
| <b>BM1 Module of Physics and Mathematics</b> | <p><b>He has an</b> idea of differential calculus of several variables, ordinary differential equations, multiple integrals, numerical and functional ranges.</p> <p><b>He is able to</b> use knowledge about the basic positions of the theory of differential and integral calculus of the functions of several variables, the theory of differential equations, the theory of series.</p> | Oral survey, testing, border control, semester work | <p><b>DM1.1.</b></p> Mathematics of Algebra and introduction to mathematical analysis<br>Математика I<br>Mathematics II<br>Mathematics III<br>Ordinary Matlab Equation differential equations in private Matlab derivatives<br>Probability Theory and Mathematical Statistics<br>Discrete Mathematics<br>Abstract algebra<br>Linear algebra and analytical geometry |
|  | <p><b>Has an idea</b> of basic concepts, laws and models of mechanics, molecular physics, electricity, magnetism, thermodynamics and statistical physics</p>   | Oral survey, testing, border control, semester work | <p><b>DM1.2.</b></p> Physics Beginnings Physics<br>Physics I Physics II   |

|  |   |  |   |
|--|---|--|---|
|  | <p><b>Capable of</b> applying theoretical knowledge to solving generalized typical physical tasks in mechanics, molecular physics and thermodynamics, electricity; working with measuring devices; conducting a physical experiment; calculating, analysing and processing the results of physical Experiment.</p>  |  |   |
| <p><b>BM2</b><br/><b>Programming</b><br/><b>Module</b></p> | <p><b>He has an idea</b> of the concepts of the program, the algorithm, the types of processes, the formal rules of the description of algorithms.<br/> <b>Capable</b> of making solution algorithms<br/>         Tasks Develop programs using Xi's language tools, Python; Organize the necessary data structures. Analyze and correct bugs in the program write programs in good Style.</p> | <p>Oral survey, testing, report, border control, semester work</p> | <p><b>DM2.1.</b><br/>Algorithmization and programming frameworks</p>        |
| <b>Professional modules (PM)</b>                           |   |  |   |
|  | <p><b>Has an idea</b> of optimization methods and variation calculus<br/> <b>He is able</b> to optimize and simplify processes using mathematical methods.</p>  | <p>Oral survey, testing, report, border control, semester work</p> | <p><b>DM1.1.</b><br/>Optimization and management<br/>Variation calculus</p> |



|   |   |  |   |
|---|---|--|---|
| <b>PM1 Mathematical Modeling Module</b> | <p><b>He has an idea</b> of the basics of mathematical analysis and diversity.<br/> <b>He is able</b> to analyze, do calculations, build graphs and apply theoretical knowledge.</p>  | Oral survey, testing, report, milestone control, semester work | <p><b>DM1.2.</b><br/>         Applied analysis<br/>         Diversity analysis<br/>         Functional analysis</p> |
|   | <p><b>He has an idea</b> of the basics of mathematical modeling of physical processes.<br/> <b>He is able</b> to set tasks, analyze and study physical processes, build mathematical models.</p>  | Oral survey, testing, report, milestone control, semester work | <p><b>DM1.3.</b><br/>         Theoretical mechanics<br/>         Mathematical Physics<br/>         Equations</p>    |
| <b>PM2 Computer Simulation Module</b>   | <p><b>He has an idea</b> of the principles and basics of programming, machine learning methods, artificial application in solving optimization problems.<br/> <b>It is able</b> to create and program processes described mathematically and algorithmically.</p> | Oral survey, testing, report, border control, semester work    | <p><b>DM2.1.</b><br/>         The basics of artificial intelligence<br/>         Machine learning methods</p>       |



## 1. Description of disciplines

### Algebra and the beginning of mathematical analysis

CODE - MAT00120 CREDIT

- 3 (1/0/2)

BEFORE THE PREKREKIT - DIAGNOSTIC test

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#### goal and GOALS OF THE COURSE

The aim of the course is to introduce students to the basic ideas and concepts algebra and mathematical analysis and the formation of the basic knowledge needed to study the course "Mathematics 1."

The challenge of the course is to develop skills to study mathematical disciplines and the effective use of mathematical methods to solve research and practical problems in the professional field.

#### SUMMARY OF THE COURSE

The course "Algebra and introduction to analysis" provides the basic concepts of algebra, mathematical analysis, differential and integral calculus.

#### KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

Student

should know:

1. Basic concepts of algebra;
2. Basic concepts of mathematical analysis
3. Basic elementary functions must be able to:
  4. To find solutions to equations and inequalities, systems of equations and inequalities;
  5. transform algebraic and trigonometry expressions;
  6. To solve text problems
  7. Find a derivative of elementary functions
  8. Explore functions using a derivative.
  9. Finding an uncertain integral from elementary functions;
  10. Find a specific integral
  11. find the area of the curved trapeze.

**Математика I**

CODE - MAT00121 CREDIT

- 3 (1/0/2)

ПРЕКРЕКВИИТ - Elementary Mathematics - School course/diagnostic test

**COURSE GOALS AND OBJECTIVES**

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The main purpose of the course is to give the future specialist a certain amount of knowledge on the sections of the "Mathematics-I" course necessary for the study of related engineering disciplines. Introduce students to ideas and concepts of mathematical analysis. Focus on basic knowledge and skills with a high degree of understanding of differential and integral calculus.

The objectives of the course: acquiring the knowledge needed to effectively use fast-paced mathematical methods; Getting the skill of building and researching mathematical models possession of the fundamental sections of mathematics necessary to solve research and practical problems in the professional field.

**SUMMARY OF THE COURSE**

The Course "Mathematics-I" gives a statement of sections: introduction to analysis, differential and integral calculus

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

Studying this discipline will allow the student to apply the course

Mathematics-I to solve simple practical problems, find tools sufficient for their research, and get numerical results in some standard situations.

**Математика II**

КОД – МАТ00122

КРЕДИТ – 3 (1/0/2)

**PREKREKIVISION - MATHEMATICS 1**

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**GOAL AND COURSE GOALS**

The purpose of teaching the Mathematics II course is to form bachelors of ideas about modern mathematics in general as a logically slender system of theoretical knowledge.

The objectives of the course **are** to instill in students solid skills of solving mathematical problems with bringing the solution to a practical and acceptable result.

**SUMMARY OF THE COURSE**

The "Mathematics-II" course provides an accessible description of sections: elements of linear algebra and analytical geometry, differential calculus of functions of many variables, multiples of integrals. Mathematics II is a logical extension of Mathematics I.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The study of this discipline will allow to apply in practice the acquired theoretical knowledge and skills with a high degree of their understanding in sections of the course, to use them at the appropriate level; To translate into mathematical language the simplest problems posed in terms of other subject areas; Acquire new mathematical knowledge using educational and information technology; to solve applied tasks in the field of professional activity.

**Математика III**

КОД – МАТ00123

КРЕДИТ – 3 (1/0/2)

ПРЕКРЕКВИИТ - Mathematics 1, Mathematics II PURPOSE

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**AND COURSE GOALS**

The purpose of teaching the Mathematics-III course is to form basic knowledge and skills *with* a high degree of understanding in sections of the course, helping to analyze and solve theoretical and practical problems.

The objectives of the course: instilling in students the skills to study the academic literature on their own, to conduct theoretical-probabilistic and statistical analysis of applied tasks; the development of logical thinking and the improvement of the overall level of mathematical culture.

**SUMMARY OF THE COURSE**

The Mathematics III course includes sections: series theory, probabilities theory and mathematical statistics, and is a logical extension of Mathematics II.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

Student

should know:

1. The theory of numerical series;
2. The theory of functional series;
3. Fourier's rows;

Elements of probability theory and mathematical statistics; must be able to:

4. To solve problems on all sections of the series theory;
5. Finding probability of events
6. Finding numerical characteristics of random values
7. use statistical methods to process experimental data.

**Физика I, II**

КОД – PHYS111-112

КРЕДИТ – 6 (2/2/2)

ПРЕКРЕКВИИТ - diagnostic test/PHYS110-111 GOAL AND

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**GOALS COURSE**

The main purpose of teaching physics I and Physics II is to forming ideas about the modern physical picture of the world and scientific contemplation.

**SUMMARY OF THE COURSE**

Disciplines Physics I and Physics II are the basis of theoretical preparation for the engineering and technical activities of graduates of the higher technical school and represent the core of physical knowledge required by an engineer operating in the world of physical patterns. The Physics 1 course includes sections: physical basics of mechanics, substance structure and thermodynamics, electrostatics and electrodynamics. Discipline "Physics II" is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of general physics as one of the basic components of general theoretical training of bachelors of engineering and technical profile. The Physics II discipline includes: magnetism, optics, nanostructures, the basics of quantum physics, atomic and nuclear physics.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

- the ability to use knowledge of fundamental laws, theories of classical and modern physics, as well as the use of physical research methods as the basis of the system of professional activity.



**Современная история Казахстана**

КОД – HUM113

КРЕДИТ – 3 (1/0/2)

**PREKREKIZIIT - NO PURPOSE**

**AND A GOAL OF THE COURSE**

The aim of the course is to introduce technical students to the main theoretical and practical achievements of the national historical science on the problems of the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of the formation and development of Kazakhstan's society.

1. Analyze the peculiarities and contradictions of Kazakhstan's history during the Soviet period;
2. to reveal the historical content of the basics of the regularities of political, socio-economic and cultural processes at the stages of the formation of an independent state;
3. contribute to the civic position of students;
4. educate students in the spirit of patriotism and tolerance, belonging to their people, the Fatherland;

**SUMMARY OF THE COURSE**

The Course Modern History of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. The modern history of Kazakhstan is studying the national liberation movement of the Kazakh intelligentsia in the early 20th century, the period of the establishment of the Kazakh ACSR, as well as the process of becoming a multinational society.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

5. Knowledge of the events, facts and phenomena of Kazakhstan's modern history;
6. Knowledge of the history of the ethnic groups that inhabit Kazakhstan;
7. knowledge of the main stages of the formation of Kazakh statehood;
8. the ability to analyze complex historical events and predict their further development;
9. The ability to work with all kinds of historical sources;
10. the ability to write essays and scientific articles on the history of the Fatherland;
11. the ability to operate in historical terms;
12. The ability to lead a discussion;
13. skills of independent analysis of historical facts, events and phenomena;
14. public speaking skills.

**Kazakh/Russian**

CODE - LNG1012-1102.1 CREDIT

- 4 (0/0/4)

BEFORE THE PREKREKIT - DIAGNOSTIC test

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goal and GOALS OF THE COURSE

1. to teach students to listen to statements on well-known topics, About home, study, leisure time;
2. Understand texts on personal and professional topics containing the most common words and expressions;
3. Be able to talk about everyday topics; Describe your experiences To express your opinion; to retell and evaluate the content of the book read, seen by the film;
4. be able to create simple texts on well-known topics, including those related to professional activities.

SUMMARY OF THE COURSE

The language material of the course was chosen in such a way that the student, assimilating the lexical and grammatical minimum, had the opportunity to get acquainted with typical communication situations and himself in such situations was able to correctly assess them and choose the appropriate model (strategy) of speech behavior.

The main focus of the training is shifted from the process of transferring knowledge to learning the ability to use the language studied in the course of various types of speech activities, such as reading (subject to reading), listening (under the same condition) and producing texts of some complexity with a certain degree of grammatical and lexical correctness.

The material for the lessons is chosen so that students, studying Kazakh/Russian, acquire the skills of reading, writing and understanding the sounding speech on the basis of simultaneous mastery of the basics of grammar (phonetics, morphology and syntax) and use in the course of repeated repeated with gradual complexity of tasks.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

Subject to active class organization and good homework, the student acquires skills corresponding to the pan-European level of A2 (Threshold according to alTE classification), i.e. he is on the verge of self-knowledge of the language by the end of the first semester..

**English**

CODE - LNG1051-1057 CREDIT

- 12 (0/0/12)

PREKREKVIIT - diagnostic test/LNG1051-1056 LNG1051

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**COURSE GOALS AND OBJECTIVES**

The English discipline "BeginnerEnglish" is designed primarily for learning from scratch. This course is also suitable for those who have only general elementary knowledge of the language. After passing this level, the student will be able to confidently communicate on the basic topics in English, learn the basics of grammar and lay a certain foundation that will improve their skills in the next stage of learning English.

Постреквизиты курса: Elementary English.

LNG1052

**COURSE GOALS AND OBJECTIVES**

"Elementary English" discipline is the foundation of english language learning, which aims to develop students' basic skills (reading and listening) and productive skills (writing and speech), analysis of basic knowledge, use and memorization of the main grammar rules and mastering the features of pronunciation and elementary vocabulary, as well as encouraging self-learning and critical thinking.

Course pre-editing: Beginner. Course post-quest:

General 1. LNG1053

**COURSE GOALS AND OBJECTIVES**

The aim of the GeneralEnglish 1 course is to provide students with the opportunity to gain sufficient knowledge to become more free in everyday social and academic settings. Students are working to improve pronunciation, vocabulary and grammar. At this level, the main task will be to consolidate the skills gained earlier, learn to compose and properly apply complex syntax designs in the English language, as well as achieve a really good pronunciation.

Пререквизиты курса: Elementary English.

Постреквизиты курса: General 2.

LNG1054

**COURSE GOALS AND OBJECTIVES**

The General English 2 course is for students who continue to study General English 1. The course is focused on the ability to actively use in practice most aspects of the Times of English, conditional sentences, phrases in passive collateral, etc. At this stage the student will be able to support the conversation with several interlocutors or express his point of view. The student significantly expands his vocabulary, which will allow him to freely express his thoughts in any environment. At the same time, the speech will be supplemented by various synonyms and antonyms of already familiar words, phrasal verbs and steady expressions.

Course pre-30s: General 1.

Постреквизиты курса: Academic English. LNG1055

#### COURSE GOALS AND OBJECTIVES

The main purpose of the Academic English course is to develop academic language skills. Discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, presentation, etc.) This course is designed to help students become more successful and effective in their learning, developing critical thinking skills and self-learning.

Пререквизиты курса: General 2. Постреквизиты

курса: Professional English. LNG1056

#### COURSE GOALS AND OBJECTIVES

"Business English" is an English language for business communication, business and career. Knowledge of business English is useful for negotiation and business correspondence, preparation of presentations and informal communication with business partners.

The peculiarities of training are that it is necessary not only to master vocabulary, but also to learn new skills: presentational, communicative, linguistic, professional.

Пререквизиты курса: IELTS score 5.0 и/или Academic English

Постреквизиты курса: Professional English, IELTS score 5.5-6.0 LNG1057

#### COURSE GOALS AND OBJECTIVES

The "Professional English" course is designed for B2-level students, whose aim is to improve the language competence of students in their respective professional fields. The main purpose of the course is to teach students to work with texts, both audio and written, by specialty. The curriculum is based on the necessary vocabulary (words and terms) often used in English for special purposes. Students will acquire professional English language skills through integrated content and language training, master vocabulary to read and understand original sources with a high degree of independence, and practice different communication models and vocabulary in specific professional situations.

Course pre-30s: Business English. Post-31s of the course:  
any elective course.

**Information and communication technologies**

CODE - CSE174

CREDIT - 3 (2/1/0) PREKIVIZIT -

NO PURPOSE AND COURSE

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**GOALS**

Learning how to apply modern information technology professional activities. The course's objectives include:

1. Uncover the basic concepts of computer system architecture;
2. Uncover the basic concepts of information and communication technologies and substantive terminology;
3. Teach to work with software interfaces of operating systems;
4. Teach to work with data in a different view, both table structured and not structured;
5. Teach to apply the basic principles of information security;
6. Uncover the concepts of data formats and media content. Learn how to work with typical media data processing applications. Use modern presentation approaches;
7. Discover the concepts of modern social, cloud and email platforms and how to work with them;
8. Learn to use algorithmization and programming techniques to solve business process automation problems

**SUMMARY OF THE COURSE**

The course contains a training program aimed at leveling students' basic knowledge in the field of information and communication technologies. Contains a complete set of topics, according to the MODEL GOSO Curriculum, with a predominance of nurturing practical data skills, algorithmization and programming. The course is designed to teach students not only basic concepts of architecture and modern infrastructure of information and communication technologies, but also to teach to use these tools for problems of an applied nature. To teach to optimize processes, to apply adequate models and methods of solving practical problems using modern methods and tools of information technology, to automate routine processes, to be productive and effective.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

Students will know:

9. Computer device;
10. The architecture of computing systems;
11. Information and communication technology infrastructure;
12. Interfaces of modern operating systems;
13. Modern tools for dealing with data of various nature and purpose;
14. Types of information security threats, principles, tools, and methods for data protection;
15. Python programming language. Students will be able to:

- Работать с интерфейсами современных операционных систем;
- 1. Work with state-of-the-art applied software to work with data of a different nature and purpose;
- 2. Apply modern social, cloud, mail platforms to organize business processes;
- 3. Programming in an algorithmic programming language;
- 4. Analyze, model, design, implement, test and evaluate information and communication technology systems

## Philosophy

CODE - 124

CREDIT - 3 (1/0/2)

PREKREKIIT - The Modern History of Kazakhstan GOAL AND

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### THE GOAL

The purpose of the course is to form a cognitive, operational, communicative, self-in-a-way competencies for problem solving:

1. contribute to the development of adequate world-views in the modern world;
2. To form creative and critical thinking among students;
3. distinguish between the relationship between spiritual and material values, their role in human life, society and civilization;
4. to help define one's attitude to life and to find harmony with the world around them.

### SUMMARY OF THE COURSE

"Philosophy" is the formation of a holistic worldview, which developed in the context of the socio-historical and cultural development of mankind. Familiarity with the basic paradigms of the methodology of teaching philosophy and education in the classical and post-classical traditions of philosophy. Philosophy is called to develop stable life orientations, gaining the meaning of its being as a special form of spiritual production. It contributes to the formation of a moral personality with the ability of critical and creative thinking. The theoretical sources of this course are the concepts of Western, Russian, Kazakh scientists on history and philosophy theory.

### KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

1. Knowing the basic terms, the main concepts and problems of philosophy;
2. Knowing the basic philosophical ways to solve ideological issues in the context of culture;
3. the ability to analyze the history of philosophical thought development;
4. the ability to determine the alternative mechanisms of staging and solving world-views issues in the history of human development;
5. the ability to identify basic theoretical approaches in the relationship between man and society;
6. The ability to master the technique of doing independent work;
7. The skills of finding material to organize
8. The skills to freely debate and make rational decisions;
- ethical principles in professional activities.



**Differential equations in private MatLab derivatives**

CODE - MAT00125 CREDIT

- 3 (1/0/2)

PRE-CRACKING - MATHEMATICS I-III

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**PURPOSE AND COURSE GOALS**

The purpose of teaching the course "Differential equations in private Derived. Matlab" is the formation of basic knowledge on course sections that help analyze, model and solve theoretical and practical problems.

The objectives of the course: to apply the theory of equations in private derivatives to solve and research applied tasks from various fields of natural science, economics, medicine, biology and ecology; to shape perceptions of the implementation of numerical methods to solve regional problems with the use of Matlab

**SUMMARY OF THE COURSE**

The basic equations of mathematical physics. Classic edge tasks for equations in private derivatives. Analytical and numerical methods of solving classic edge problems. Use Matlab to solve regional problems numerically.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

1. to master this mathematical apparatus, which allows to analyze, model and solve classic boundary problems;
2. Master the methods of solving classic edge problems;

To be able to pose a problem, to choose methods of solution, both analytically and using computer technologies;

3. Use the modern Software-Package Matlab;
4. Master the methodology and skills of numerical implementation of the mathematical model, analysis of the results, interpretation of them to clarify the model;
5. self-expand their mathematical knowledge.



**Алгоритмизация и основы программирования**

CODE CSE 155

CREDIT - 1/1/1

PREKREKVIIT - Information and communication technologies GOAL AND

GOALS COURSE:

This course aims to explore the effective use of data structures and algorithms to solve different problems. The student will learn to understand the logical connections between the data structures associated with tasks and their live examples and applications. The course contains such topics as - algorithms, data building, arrays, search algorithms, stack, queues, one and two related lists, trees, sorting, hash tables, heaps, arithmetic algorithms, graphs. The course is based on Xi as the primary high-level language in building system and basic language applications to learn data types, data structures, call mechanisms, and memory-based principles.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The student will be able to determine the asymptomatic complexity of the algorithm. Be able to determine the correct form of data storage depending on the task, determine the best ways to solve the problem based on their architecture of the computer. The student is familiar with the most famous data processing algorithms. Learn to use data structures such as array, stack, queue, coherent list, hash table, tree, graph.

The student will be able to effectively apply different data structures to find the best solutions to the problem. Programming in Xi.

|              |  |                         |               |
|--------------|--|-------------------------|---------------|
| Разработано: | Рассмотрено: заседание УС<br>Института | Утверждено: УМС КазНИТУ | Страница 1 из |
|--------------|--|-------------------------|---------------|

**Object-oriented programming**

CODE -CSE127

CREDIT - 3 (2/1/0)

BEFORE THE PREKREKITE - Algorithmization and basic programming goal

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and GOALS COURSE

The aim of studying this discipline is to learn models by students create software based on high-level languages - object-oriented languages that allow you to operate user data themes and set rules for working on them.

**SUMMARY OF THE COURSE**

The paradigm of object-oriented programming fundamentally defines the principles of scalable software creation using a high-level method of designing business environment concepts in the programming language. Today, there are many object and object-oriented programming languages, and the most appropriate languages for an academic course are such languages as Java and SJ, on the basis of one of which the discipline program is built. The principles of abstraction, encapsulation, inheritance and polymorphism are studied. The most commonly used software design patterns are studied.

The focus is on learning to develop practical software skills. The course aims to solve a large number of problems by writing software codes using the PLO paradigm.

**KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

As a result of the course, students will gain the necessary knowledge about the object-oriented approach of programming. They will learn to highlight the abstractions of business processes, the mechanisms of interaction of these abstractions. They will learn how to use tools of inheritance, encapsulation of data, polymorphism. Learn how to use effective approaches when writing code using well-established design patterns.

**Discrete Mathematics**

CODE MAT113 CREDIT

-1/0/2

PREKREKITE - Mathematics I, Mathematics II PURPOSE AND COURSE GOALS

The aim of the Discipline Mathematics (DM) discipline is to develop basic mathematical knowledge under the basis of computer technology.

The task of studying the discipline is to study the sections of discrete mathematics necessary for the subsequent mastery of knowledge on the protection and security of information.

SUMMARY OF THE COURSE

Discipline examines coding theory, set theory, graph theory, mathematical logic.

KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE

As a result of studying the discipline, the student should know:

1. The basics of coding theory, set theory, graph theory;
2. The theory of algebra logic;
3. mathematical apparatus of synthesis and analysis of digital devices. As a result of studying the discipline, the student should be able to:
  4. transform bullies,synthesize minimal combination schemes;
  5. encoding.

**Ordinary differential equations**

CODE - MAT00124 CREDIT

- 3 (1/0/2)

PRE-CRACKING - MATHEMATICS I-III

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**PURPOSE AND COURSE GOALS**

The aim of teaching the course is "Ordinary differential equations.

Matlab" is the development of basic course-section knowledge that helps to analyze, model and solve theoretical and practical problems in both analytical and numerical ways using Matlab; instilling in students the skills to study academic literature on their own.

The course tasks teach to recognize the types and shapes of integrated equations and systems, integrate them and apply differential equations for mathematical solving of applied problems.

**SUMMARY OF THE COURSE**

Ordinary differential equations of the 1st order. Ordinary differential equations of higher orders. Systems of differential equations. Linear equations with variable odds. Numerical integration of differential equations and systems. Use Matlab to numerically solve differential equations.

**The theory of the function of the actual variable**

CODE - MAT139

CREDIT - 3 (1/0/2)

PREKREKITE - MATHEMATICS

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I-II PURPOSE AND COURSE

GOALS

The purpose of teaching the "Theory of The Function of The Real Variable" course is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The course's tasks are to teach to recognize the most important private cases of measures: the measure of Lebeg, the measure of Borel, the measure of Stilles and its generalization - a stratified measure.

SUMMARY OF THE COURSE

Discipline is devoted, mainly to the theory of measure and integral of Lebeg. Definitions of sigma-algebra are given on abstract sets and measures on such algebra. The most important private measures are considered: the Lebeg measure, the Borel measure, the Stillies measure and its generalization - a stratified measure. Next is the definition of Lebeg's integral and the main theorems about Lebeg's integral (Theorem Byepo Levy, Lemma Fatu, Legeg's theorem of majores, theerem Fubini). Some functional spaces associated with Lebeg's integral are being studied. Definitions of divergence and laplasian are given by stratified measure. Discipline plays a very important role in the study of the theory of equations with private derivatives and mathematical physics.

**Differential geometry and topology**

CODE - MAT140

CREDIT - 3 (1/0/2)

BEFORE THE WORLD - Diversity

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Analysis

**COURSE GOALS AND OBJECTIVES**

The purpose of teaching the course "Differential Geometry and Topology" is to create basic knowledge on the course sections, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The course tasks are to be taught to analyze surface curves.

**SUMMARY OF THE COURSE**

Differential geometry has become an important part of mathematical science required by mathematicians, economists, engineers, physicists and other scientists in recent years. This requirement reflects the importance and widespread application of the subject.

The course contains virtually all the main themes of differential geometry of curves and surfaces that will be useful for students of economic and computer specialties, and can be considered within one semester.

**Equations in private derivatives. Matlab**

CODE - MAT00125

CREDIT - 3 (1/0/2)

PREKREKVIIT - Ordinary

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differential equations. Matlab

**COURSE GOALS AND**

**OBJECTIVES**

The aim of teaching the course is "Equations in private derivatives. Matlab" is the formation of basic knowledge on course sections that help analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The course tasks teach to recognize and calculate the task of Sturm-Liuville, the edge tasks for equations in private derivatives.

**SUMMARY OF THE COURSE**

Equations in private derivatives have been an important part of mathematical science required by mathematicians, economists, engineers, physicists and other scientists in recent years. This requirement reflects the importance and widespread application of the subject.

The course contains almost all the main themes about differential equations, but the main focus will be the task of Sturm-Lyuville, the edge task for equations in private derivatives. Numerical methods of solving regional problems.

**Optimization and management**

CODE - MAT141

CREDIT - 3 (1/0/2)

PREKREKVIIT - Mathematics III,

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Linear Algebra and Analytical

Geometry

COURSE GOALS AND

OBJECTIVES

The purpose of teaching the course "Optimization and Management" is to create basic knowledge on the sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The objectives of the course are to teach optimization methods based on the allocation of resources with the best possible effect.

SUMMARY OF THE COURSE

Optimization is the art and science of distributing limited resources with the best possible effect. Optimization techniques are used every day in matters of industrial planning, resource allocation, planning, decision-making, etc. It is difficult to overestimate the importance of optimization theory for engineering students. This requirement reflects the importance and widespread application of the subject.

The course is designed for students of MKM (mathematical and computer modeling). He describes basic optimization techniques, including linear programming, dynamic programming, networking, and game theory.



**Functional analysis**

CODE - MAT142

CREDIT - 3 (1/0/2)

BEFORE THE REVIEW - Diversity

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Analysis, Theory of The Real

Variable Function

**COURSE GOALS AND**

**OBJECTIVES**

The purpose of teaching the Functional Analysis course is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study the literature themselves.

The course's tasks are to teach to recognize linear spaces, equipped with metrics or norms, conjugated spaces, linear operators and their attached, self-equipped operators in gilbert spaces.

**SUMMARY OF THE COURSE**

Functional analysis is an integral part of the mathematical background required by mathematicians, economists, engineers, physicists and other scientists. It is difficult to overestimate the importance of functional analysis for engineering students. This requirement reflects the importance and widespread application of the subject. The course is designed for students of MKM (mathematical and computer modeling). It contains the following chapters: linear spaces, equipped with metrics or norms, conjugated spaces, linear operators and their attached, self-equipped operators in gilbert spaces, elements of spectral theory, theorems about the fixed point and their applications.

**The theory of the functions of the complex variable**

CODE - MAT104

CREDIT - 3 (1/0/2)

PREKREKVIIT - Ordinary

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differential equations. Matlab

**COURSE GOALS AND**

**OBJECTIVES**

The purpose of teaching the course "The Theory of Integrated Variable Functions" is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The tasks of the course teach to recognize the basic concepts of complex analysis, representation of functions in rows, functional rows, sedate rows, Taylor's ranks, the ranks of Laurent.

**SUMMARY OF THE COURSE**

The "Integrated Variable Function Theory" course includes sections: basic concepts of integrated analysis, representation of features in rows, functional rows, staid rows, Taylor's rows, Laurent's rows, special points, deductions and their applications, Laplace transformation, Laplace transformation properties, some operational calculus applications.

**Cryptography**

CODE - MAT143

CREDIT - 3 (1/0/2)

PREREKVIIT - Abstract algebra

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**COURSE GOALS AND**

**OBJECTIVES**

The purpose of teaching the Course "Cryptography" is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The course tasks teach to recognize elements of algebraic structures (groups, ring fields) and applications of algebra in cryptography.

**SUMMARY OF THE COURSE**

The Cryptography course contains two main parts: elements of algebraic structures (groups, ring fields) and algebra applications in cryptography. The main purpose of this course is a structural theorem for euclidean rings and the construction of a crypto system without repetition.

## Mathematical Physics Equations

CODE - MAT144

CREDIT - 3 (1/0/2)

PREKREKVIIT - Equations in

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private derivatives. Matlab

### COURSE GOALS AND

### OBJECTIVES

The purpose of teaching the course "Mathematical Physics Equations" is to form basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The course's tasks will be to introduce students to ideas and concepts of mathematical physics.

### SUMMARY OF THE COURSE

The main topics of the course are: linear and quasi-linear equations in private derivatives, hyperbolic equations and some methods of their research, elliptical equations in private derivatives, some qualitative properties of their solutions, weak solutions, classical solutions, The Poinre-Perron method, parabolic method. equations, the qualitative properties of their solutions, the Fourier method.

## Variation calculus and optimal management

CODE - MAT145

CREDIT - 3 (1/0/2)

BEFORE THE PREKREKIIT -

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Optimization and management

COURSE GOALS AND

OBJECTIVES

The purpose of the "Variation Calculus and Optimal Management" course is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The objectives of the course are to teach algorithmic methods of finding extremes, methods of achieving necessary and sufficient conditions, conditions that ensure the existence of extremes.

SUMMARY OF THE COURSE

Variation calculus is a section of mathematics associated with manipulating functionality to solve variation problems. Variation calculus concerns algorithmic methods of finding extremes, methods of achieving necessary and sufficient conditions, conditions that ensure the existence of extremes, quality tasks, etc.

The course is designed for students of MKM (mathematical and computer modeling). He describes basic optimization methods, including linear programming, dynamic programming, networks, and variation.

**Introduction to artificial intelligence**

CODE - MAT146

CREDIT - 3 (1/0/2)

PREKREKVIIT - Data analysis

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**COURSE GOALS AND****OBJECTIVES**

The purpose of teaching the "Introduction to Artificial Intelligence" course is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The tasks of the course are to teach to work with data (collecting, analyzing, extracting useful information), to build models of machine learning, and in practice will strengthen knowledge in some fundamental disciplines.

**SUMMARY OF THE COURSE**

Artificial intelligence is a very abstract concept closely related to data science and machine learning. In the context of this discipline, we will understand it as a set of universal tools to automate processes in which human participation used to be required.

After this course, students will get basic knowledge on how to work with data (collection, analysis, extraction of useful information), build models of machine learning, and in practice will gain knowledge in some fundamental disciplines, for example, such as mathematical analysis, linear algebra, probability theory, statistics, optimization and programming.

Studying this discipline will allow future graduates to prepare for work in the field of artificial intelligence. The course will be useful for those who are going to continue scientific activity, and for those who plan to enter the industry.

**Applied analysis**

CODE - MAT147

CREDIT - 3 (1/0/2)

ПРЕРЕКВИЗИТ – Математика III

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**COURSE GOALS AND**

**OBJECTIVES**

The purpose of teaching the Applied Analysis course is to develop basic knowledge in sections of the course, helping to analyze, model and solve theoretical and practical problems in both analytical and numerical methods; instilling in students the skills to study academic literature on their own.

The objectives of the course are to apply methods of solving second-order differential equations, theorems of existence and singularity, linear equations of the second order, solutions to second-order systems of equations, non-linear equations and applications.

**SUMMARY OF THE COURSE**

This course is an introduction to the theory, solution and application of differential equations with boundary values. Topics discussed in the course include methods of solving second-order differential equations, existence and singularity theorems, second-order linear equations, second-order systems of equations, non-linear equations and applications. Introduction to numerical solutions is also provided. The applications of differential equations in physics and chemical engineering are presented.

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