AL-FARABI KAZAKH NATIONAL UNIVERSITY

EDUCATIONAL PROGRAM IN ENGLISH
INDUSTRIAL INFORMATION SYSTEMS

Specialty 5B070300 – Information Systems

Almaty, 2016

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Passport

OF EDUCATIONAL PROGRAM IN ENGLISH

“INDUSTRIAL INFORMATION SYSTEMS”

Speciality	5B070300 – Information systems
The level of the International standard classification of education (LISC 2011)	6 – bachelor
Purpose of program	The aim of the educational program is formation of knowledge and skills needed to design, support and development of industrial information systems for management of industrial production.
Professional activities	IT specialist; Web Programmer; Database Developer; Systems Analyst
The types of economic activities NCEA in which this profession is in demand	58.2 Edition of the software 58.29 Edition other software 62 Computer programming, consultancy and other related services 62.01.2 Software Maintenance 62.02 Consulting services in the field of computer technology 62.03.0 Activities Computer facilities management 62.09 Other activities in the field of information technology and computer systems 63 Information service Activities 63.1 Services for the disposal and processing of data; web portals 63.11 Hosting and processing of data and other services 63.9 Other information services 63.12 Web portals 70.22.0 Advice on business and management 71.12 Activities in the field of engineering activities and related technical consultancy

Competence specialist (CC – cultural competence, PC professional competence)

Code of competence	Description of competence
CC-1	knowledge of the basic stages of the recent history of progressive development of statehood of Kazakhstan, in the context of the world and Eurasian historical process;
CC-2	the ability to interpret and creatively use a scientific-historical and philosophical knowledge to summarize the success factors of Kazakhstan's model of development on the way to held the state – the Republic of Kazakhstan;
CC-3	communication skills (readiness for effective oral and written communication in the course of their professional activities, including, if necessary, and in a foreign language);
CC-4	ethics engineering (readiness for conducting engineering activities in compliance with the general culture of ethics and professional ethics Engineer Code);
CC-5	compliance with laws and regulations (the willingness to comply with all legal standards and requirements, including with regard to health and safety compliance in the management of engineering activities);
CC-6	willingness to cooperate with colleagues, work in a team;

CC-7	social responsibility (adoption of the common good as a top priority of engineering activity, readiness to bear responsibility for the social, cultural and environmental implications of the complex engineering activities in the context of sustainable development);
PC-1	the breadth and depth of knowledge in design, support and development of industrial information systems (the possession of broad and deep fundamental and applied knowledge and the willingness to use them as a basis for practical engineering activities, knowledge and use of best engineering practice in industrial information systems, knowledge and use of the software used in the design, support and development of industrial information systems);
PC-2	meaningful use of knowledge, taking into account the specifics of a particular situation in design, support and development of industrial information systems (ready to apply fundamental engineering knowledge and taking into account national specifics, technical standards and professional standards);
PC-3	an analysis of engineering problems in design, support and development of industrial information systems (ready for staging, testing and analysis of complex engineering problems in design, support and development of industrial information systems; ability to evaluate and select the necessary information, the ability to apply the necessary theoretical and practical methods for the analysis of complex engineering problems design, support and development of industrial information systems);
PC-4	development and adoption of engineering solutions in design, support and development of industrial information systems (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of industrial information systems; willingness to solve if necessary methodological problems and research character, willingness to develop and adopt solutions of complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense);
PC-5	evaluation of engineering activities in design, support and development of industrial information systems (ready to evaluate the significance of the results and consequences of a complex engineering activity in design, support and development of industrial information systems);
PC-6	the organization and management of engineering activities in design, support and development of industrial information systems (ready to partial or complete management of one or more kinds of complex engineering activities, the ability to apply knowledge to help ensure quality assurance, operational reliability, use of technical information and statistics, and the ability to work in teams on interdisciplinary projects; willingness to be a leader, develop a strategy to solve organizational, technical and financial issues and personnel management);
PC-7	search and innovation in design, support and development of industrial information systems (knowledge is constantly ongoing technological changes, economic situation, the modern industrial and environmental trends and issues, and the ability to generate new knowledge of the fundamental interdisciplinary and intersectoral character, commitment to innovation and the search for creative solutions in engineering);
PC-8	responsibility for engineering solutions in design, support and development of industrial information systems (ready to be responsible for making decisions in the management of complex engineering activity);
PC-9	education throughout life (continuous readiness for further training and professional development, adequate for the maintenance and development of competences);

The correlation of the expected learning outcomes of the program on the learning and evaluation tools in the formation of competence

The cipher and name of competence	Expected results (components of competence)	Modules, practice
CC-1 knowledge of the basic stages of the recent history of progressive development of statehood of Kazakhstan, in the context of the world and Eurasian historical process; CC-2 the ability to interpret and creatively use a scientific-historical and philosophical knowledge to summarize the success factors of Kazakhstan's model of development on the way to held the state – the Republic of Kazakhstan; CC-3 communication skills (readiness for effective oral and written communication in the course of their professional activities, including, if necessary, and in a foreign language); CC-4 ethics engineering (readiness for conducting engineering activities in compliance with the general culture of ethics and professional ethics Engineer Code); CC-5 compliance with laws and regulations (the willingness to comply with all legal standards and requirements, including with regard to health and safety compliance in the management of engineering activities); CC-6 willingness to cooperate with colleagues, work in a team; CC-7 social responsibility (adoption of the common good as a top priority of engineering activity, readiness to bear responsibility for the social, cultural and environmental	*Knowledge:* The basic stages of the recent history of progressive development of statehood of Kazakhstan (1991-2014.) in the context of the world and Eurasian history.The ability to interpret and creatively use a scientific-historical and philosophical knowledge to summarize the success factors of Kazakhstan's model of development on the way to held the state the Republic of Kazakhstan. Competent use of language and of linguistic and cultural knowledge to solve problems of communication in multilingual and multicultural society of the Republic of Kazakhstan and in the international arena. The of automated data processing; appointment, composition, basic characteristics of computer and office equipment, basic methods and means of processing, storage, transmission and accumulation of information, purposes and principles of the use of application and system software; technology-information search on the Internet, key threats and methods of information security, principles of information protection from unauthorized access, legal aspects of using information technologies and software. Define the main tendencies in the field of information communication technologies; to know what economic and political factors promoted development of information communication technologies; to know architecture, to be able to calculate and evaluate performance measures of supercomputers; to know features of different operating systems. *Skill:* In modern conditions to implement the study of the history of the state and of law, based on research experience and knowledge in order to recreate an objective picture of the history of the state and the law of the country;	**1. GENERAL EDUCATION Compulsory Component** **(21 credits)**

implications of the complex engineering activities in the context of sustainable development).	Speaking: express their thoughts and to speak in a foreign language, respectively, speech language standards, ask questions and answer them, hold a conversation in a foreign language in the volume of the studied subjects, consuming adequate communication cues to convey the contents read, heard. Develop and defend their own scientific positions; to decide the theoretical and methodological issues in the branch of science. Use information resources for search and information storage; to apply methods and means of information protection; to project and create simple web sites; to make processing of vector and bitmap images; to use different forms of e-learning for extension of professional knowledge; to use different cloud services.	
CC-3 communication skills (readiness for effective oral and written communication in the course of their professional activities, including, if necessary, and in a foreign language); PC-1 the breadth and depth of knowledge (the possession of broad and deep fundamental and applied knowledge and the willingness to use them as a basis for practical engineering activities, knowledge and use of best engineering practice in a selected area of professional activities, knowledge and use of the software used in the design, support and development of industrial information systems); PC-4 development and adoption of engineering solutions (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of industrial information systems); willingness to solve if necessary methodological problems and research character, willingness to develop and adopt solutions of	*Knowledge:* Modern vocabulary and terminology in English for technology and project management methodology, project management processes, modern software project management. The mathematics: concepts and principles in mathematics; differential and integral calculus, linear algebra, probability theory, statistics, optimization methods, the acquisition of skills in the use of mathematics for modeling in industrial information systems. Essence of the basic concepts, laws and theories of classical and modern physics in their internal relationships and integrity; hierarchy of physical laws and concepts, the boundaries of their applicability, allowing to use them effectively in specific situations; to simulate the physical situation of the computer; carrying out experimental research and processing of results, the ability to allocate physical content in applications of the future specialty. The probabilistic and statistical concepts, simple probability and its estimation; random variable, its numerical characteristics and their evaluation; basic assessment methods. The fundamental principles of algorithm design: divide and conquer techniques, graph algorithms, data structures (heap, hash tables, search trees); modern technologies of constructing algorithms based on structures	**2.** **BASIC DISCIPLINES** **Compulsory Component** **(20 credits)**

complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense); PC-7 search and innovation (knowledge is constantly ongoing technological changes, economic situation, the modern industrial and environmental trends and issues, and the ability to generate new knowledge of the fundamental interdisciplinary and intersectoral character, commitment to innovation and the search for creative solutions in engineering);	of the used data and the computer systems for industrial information systems. The principles underlying layered systems architectures and their application to both computers and networks; differences and similarities between the core elements of an IT infrastructure solution, such as clients, servers, network devices, wired and wireless network links, systems software, and specialized security devices; role of IT control and service management frameworks in managing industrial information systems; analyze and understand the security and business continuity implications of IT How IT infrastructure components are organized into infrastructure solutions in industrial information systems; configure an IT infrastructure solution for a small organization, including a network based on standard technology components, servers, security devices, and several different types of computing clients. *Skill:* Apply organizational project management tools to determine the hierarchical structure of the project works, use of formal methods of evaluating the time and resources of the project objectives, determine the amount and sources of funding, to plan and to consider the risks. Generalized solutions of typical problems (theoretical and experimental and practical learning tasks) from different areas of physics as the basis of decision of professional problems. Simulate the physical situation of the computer. The ability to apply in practice, numerical methods differentiability and integrability. Get the practical skills to apply differential and integral calculus in problems of mechanics and physics. Skillful use of regression analysis. To be able to use the correlation analysis of random processes. To construct efficient algorithms and implement them in programming languages; to carry out the lexical analysis, parsing, effective implementation of the software.	

	Apply the core concepts underlying IP networks to solve simple network design problems, including IP subnetting. Analyze and understand the security and business continuity implications of IT infrastructure design solutions.	
PC-2 meaningful use of knowledge, taking into account the specifics of a particular situation (ready to apply fundamental engineering knowledge and taking into account national specifics, technical standards and professional standards); PC-4 development and adoption of engineering solutions in design, support and development of industrial information systems (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of industrial information systems; willingness to solve if necessary methodological problems and research character, willingness to develop and adopt solutions of complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense);	*Knowledge:* How and why information systems are used today; the technology, people, and organizational components of industrial information systems; how businesses are using industrial information systems for competitive advantage vs. competitive necessity; the value of information systems investments as well as learn to formulate a business case for a new industrial information system, including estimation of both costs and benefits; the major components of an industrial information systems infrastructure; how various types of information systems provide the information needed to gain business intelligence to support the decision making for the different levels and functions of the organization. The role of databases and database management systems in managing organizational data and information; the basics of how data is physically stored and accessed; design high-quality relational databases; the purpose and principles of normalizing a relational database structure; implement a relational database design using an industrial-strength database management system, including the principles of data type selection and indexing; the data definition, data manipulation, and data control language components of SQL in the context of one widely used implementation of the language; the concept of database transaction and apply it appropriately to an application context; the basic mechanisms for accessing relational databases from various types of application development environments; the role of databases and database management systems in the context of industrial information systems; the key principles of data security and identify data security risk and violations in data management system design. *Skill:* Confidently own methods of statistical data analysis, methods of regression and correlation analysis, numerical methods of statistical data processing. To possess the basic techniques of the analysis of economic and	**3. MAJORS Compulsory Component** **(5 credits)**

	technical information with modern technologies from Microsoft, Oracle and Intel. The of identifying organizational information requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational data models and verifying its structural characteristics with normalization techniques, and implementing and utilizing a relational database using an industrial-strength database management system.	
PC-1 the breadth and depth of knowledge in design, support and development of industrial information systems (the possession of broad and deep fundamental and applied knowledge and the willingness to use them as a basis for practical engineering activities, knowledge and use of best engineering practice in industrial information systems, knowledge and use of the software used in the design, support and development of industrial information systems); PC-5 evaluation of engineering activities in design, support and development of industrial information systems (ready to evaluate the significance of the results and consequences of a complex engineering activity in design, support and development of industrial information systems);	*Knowledge:* The of programming paradigms, syntax and semantics of programming languages, basic models, approaches and techniques of programming; basic structures of programming languages for writing algorithms, types, and data structures; technology design and development industrial information systems; software architecture. Principles of designing and functioning serial technical and program-technical automation, the structure and functional the software of industrial information systems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Understand how technologies are increasing the ability of organizations to globalize business processes and to extend their reach to global customers. *Skill:* Elect technical and program-technical means for creation of ACP and ACS, to execute design layout, technical and program-technical means of automation. Design and development industrial information systems;	**4. GENERAL EDUCATIO N Elective Course** **(7 credits GE)**
PC-4 development and adoption of engineering solutions (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of	Knowledge: The fundamentals and applications of digital electronics and microprocessors. On service, analysis and improvement of industrial information systems.	**5.BASIC DISCIPLINES Elective Course (49 credits)**

industrial information systems); willingness to solve if necessary methodological problems and research character, willingness to develop and adopt solutions of complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense); PC-5 evaluation of engineering activities in design, support and development of industrial information systems (ready to evaluate the significance of the results and consequences of a complex engineering activity in design, support and development of industrial information systems); PC-7 search and innovation in design, support and development of industrial information systems (knowledge is constantly ongoing technological changes, economic situation, the modern industrial and environmental trends and issues, and the ability to generate new knowledge of the fundamental interdisciplinary and intersectoral character, commitment to innovation and the search for creative solutions in engineering);	The of principles of theory of circuits and electrical machines. Applied knowledge of electrotechnology. The of principles of design and development of microprocessor-based automation and control systems with the use of modern tools for industrial information systems. The of modern methods of digital signal processing (modeling of time series, the theory of discrete linear systems, an adaptive interference suppression and spectral analysis). *Skill:* Developed computational algorithms and programs the implementation of which is based on universal microprocessors and modern instrumental systems programming for industrial information systems. Organize and plan in the field of the company, and other institutions and organizations. Solve the coupling problem of automated control systems and mathematical, physical, chemical, biological process models. Applied knowledge of industrial computing and communications. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Handle specifications, regulations and mandatory rules. Alleged affiliation: independent custom development; companies that develop software; large organizations that are developing or modifying software for industrial information systems.	
PC-2 meaningful use of knowledge, taking into account the specifics of a particular situation (ready to apply fundamental engineering knowledge and taking into account national specifics, technical standards and professional standards); PC-8 responsibility for engineering solutions in design, support and development of industrial information systems (ready to be responsible for making decisions in the management of complex engineering activity);	*Knowledge:* The subject of operations research and its methodology, elements of convex analysis, basic problems of mathematical programming, convex programming, linear programming problems. Knowledge of the basic concepts and statements of simulation theory for industrial information systems. The basic approaches and methods used in the simulations of telecommunication networks and systems.	

	The basic methods and algorithms for constructing artificial intelligence systems, control systems, fuzzy logic, expert systems and neural network control systems. The principles of modern organization of databases and database systems, basic categories and concepts of databases; different models of data presentation; methods of database design, advanced data processing technologies in industrial information systems. *Skill:* Successfully applied setting skills of optimization problems of the economy, logistics, inventory management theory, scheduling theory. To be able to use numerical methods for solving optimization problems, problems of modeling of economic, administrative processes, monitoring processes, customer service. Design the industrial information model specific system and method of protection, the use of modern programming languages, data processing, and use advanced features to protect networks and operating systems and their analysis. Development of the large amount of information; simulation models in GPSS programming environments, MATLAB. Setting skills of experimental research for the solution of scientific research tasks in the field of telecommunication networks and systems. Explore DWH and OLAP, and devise efficient and cost effective methods for maintaining DWHs. Select and apply proper data mining algorithms to build analytical applications.	
CC-4 ethics engineering (readiness for conducting engineering activities in compliance with the general culture of ethics and professional ethics Engineer Code); CC-7 social responsibility (adoption of the common good as a top priority of engineering activity, readiness to bear responsibility for the social, cultural and environmental implications of the complex engineering activities in the context of sustainable development);	*Knowledge:* Basic knowledge of production and manufacturing systems. Capacity for management of the activities covered by the engineering projects. About occupational health and safety, prevention of occupational hazards and safety in machines, according to the current legislation on passive and active protection on fires, and aspects of noise pollution.	

PC-3 an analysis of engineering problems (ready for staging, testing and analysis of complex engineering problems in design, support and development of industrial information systems); ability to evaluate and select the necessary information, the ability to apply the necessary theoretical and practical methods for the analysis of complex engineering problems design, support and development of industrial information systems); PC-5 evaluation of engineering activities (ready to evaluate the significance of the results and consequences of a complex engineering activity in design, support and development of industrial information systems); PC-6 the organization and management of engineering activities (ready to partial or complete management of one or more kinds of complex engineering activities, the ability to apply knowledge to help ensure quality assurance, operational reliability, use of technical information and statistics, and the ability to work in teams on interdisciplinary projects; willingness to be a leader, develop a strategy to solve organizational, technical and financial issues and personnel management); PC-8 responsibility for engineering solutions (ready to be responsible for making decisions in the management of complex engineering activity).	Basic technical and economic requirements for automation using tools of ERP systems; organization and management of the development process, implementation and support of ERP systems. Automatic regulation and control techniques and its application to industrial automation. In basic and technological subjects, which will enable them to learn new methods and theories, and give them the versatility to adapt to new situations. The basic techniques of designing the architecture of corporate industrial systems based on programming techniques; the basic elements of the theory of industrial systems, templates, design and administration of industrial information systems based on Share Point technology. Know the basics of programming networking and remote access to the ERP-system. *Skill:* Use contemporary CASE tools for the use in process and data modeling. Design high-level logical system characteristics (user interface design, design of data and information requirements). Ability to organize and plan in the field of the company, and other institutions and organizations. Apply information to the needs of different industries and areas. Be able to apply the skills of information systems software, remote access to the corporate system. Apply microprocessor based multi-function relays on protection of various power system equipment and apparatus.	
PC-4 development and adoption of engineering solutions in design, support and development of industrial information systems (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of industrial information systems; willingness to solve if necessary methodological	*Knowledge:* Understand the various functions and activities within the industrial information systems area, including the role of IT management and the CIO, structuring of IS management within an organization, and managing IS professionals within the firm. Understand a variety of frameworks for enterprise architecture analysis and decision making.	

problems and research character, willingness to develop and adopt solutions of complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense); PC-7 search and innovation (knowledge is constantly ongoing technological changes, economic situation, the modern industrial and environmental trends and issues, and the ability to generate new knowledge of the fundamental interdisciplinary and intersectoral character, commitment to innovation and the search for creative solutions in engineering);	Understand the concepts of user differences, user experience and collaboration as well as how to design contextually. *Skill:* Ability to handle specifications, regulations and mandatory rules. Design and development of information security management system and the organization of production safety. Analyze the system of information security organization and production. Apply core program control structures. Apply contemporary techniques to evaluate computer interfaces.	
PC-6 the organization and management of engineering activities in design, support and development of industrial information systems (ready to partial or complete management of one or more kinds of complex engineering activities, the ability to apply knowledge to help ensure quality assurance, operational reliability, use of technical information and statistics, and the ability to work in teams on interdisciplinary projects; willingness to be a leader, develop a strategy to solve organizational, technical and financial issues and personnel management); PC-8 responsibility for engineering solutions (ready to be responsible for making decisions in the management of complex engineering activity);	*Knowledge:* On business, management, finances, economics and marketing. Business analysis knowledge The company concept, institutional and legal framework of the company. Understand the challenges and risks concerning business process outsourcing, especially those dealing with ethnic cultural differences from offshore engagements. Knowledge of the fundamentals of electronics. Understand the foundations of project management, including its definition, scope, and the need for project management in industrial information systens Manage project quality, including the identification of the threats to project quality, techniques for measuring project quality, and the techniques for ensuring project quality is achieved. Basic methods and algorithms for constructing artificial intelligence systems, control systems, fuzzy logic, expert systems and neural network control systems. *Skill:* Develop methods and algorithms to solve them; has mastered the principles of electrical circuits containing semiconductor devices.	**6. MAJORS Elective Course (10 credits)**

	Generalized solutions of typical problems (theoretical and experimental and practical learning tasks) from different areas of Theory of Electrical Circuits as the basis of decision of professional problems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Simulate simple business processes and use simulation results in business process analysis. Development and operation of control systems having elements of artificial intelligence. Apply new methods to solve problems in their area of concern. Make a comparative analysis and artificial intelligence to justify the choice of language. Manage project risk, including the identification of project risk, and the techniques for ensuring project risk is controlled.	
PC-2 meaningful use of knowledge, taking into account the specifics of a particular situation (ready to apply fundamental engineering knowledge and taking into account national specifics, technical standards and professional standards); PC-4 development and adoption of engineering solutions (the ability to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering in solving complex engineering problems in design, support and development of industrial information systems); willingness to solve if necessary methodological problems and research character, willingness to develop and adopt solutions of complex engineering problems in difficult conditions with conflicting requirements and lack of information, common sense);	*Knowledge:* Basic concepts and definitions of object-oriented programming, a methodological framework for building software industrial information systems. Principles, techniques of building software systems for industrial information systems. Basic concepts of real-time systems, models and methods of real-time systems developing. Functions, classification of artificial intelligence systems; fundamental principles for the development of artificial intelligence systems; current trends in the field of artificial intelligence. Principles and applications of robotic systems in industry. General principles of software development in the development of complex software and software intensive systems; methods and techniques for software management, and also to be able to use these in industrial information systems; master general principles and techniques for dealing with quality attributes for various types of software industrial information systems (e.g. security and reliability).	**7. Individual educational trajectories (IET) (15 credits)**

	Skill: Apply general principles of software development in the development of complex software and software intensive systems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Transcend cultural, social and financial differences and work in international teams, proactively plan and manage one's future career, as well as personal development. Be able to carry out development and debugging of programs written in Prolog using basic structures and methods of logic programming, develop a simple database, the decision tree.	
PC-6 the organization and management of engineering activities (ready to partial or complete management of one or more kinds of complex engineering activities, the ability to apply knowledge to help ensure quality assurance, operational reliability, use of technical information and statistics, and the ability to work in teams on interdisciplinary projects; willingness to be a leader, develop a strategy to solve organizational, technical and financial issues and personnel management); PC-9 education throughout life (continuous readiness for further training and professional development, adequate for the maintenance and development of competences);	*Knowledge:* Principles, models and methods of business process management. Principles of modern organization of databases and database systems, basic categories and concepts of databases; different models of data presentation; methods of database design and administration for industrial information systems. Standards of information systems service, using these standards for service of industrial information systems. The cloud technologies for the using in industrial information systems. The tools for the development of networks and Internet use, as well as hardware specific to home networks and networks of small businesses. *Skill:* Applied knowledge of business process management with software tools. Administration and monitoring local computer networks, which are considered the key principles underlying the basis of the routing, remote access, addressing and network services. To able make and solve questions of IIS service via using of standards.	
CC-7 social responsibility (adoption of the common good as a top priority of engineering activity, readiness to bear responsibility for the social, cultural and environmental	*Knowledge:*	**8. Interdisciplinary** disciplines (2 credits)

implications of the complex engineering activities in the context of sustainable development).	The role of entrepreneurship in economic development. Basic forms and types of businesses. Planning framework, organization and management of the enterprise. Culture and ethics of the entrepreneur. Competence in the design of mechanisms for the management of the company, the understanding of innovation processes prevailing in the company. The basic concepts of project management in industrial information systems.foundations of statistical estimation and analysis of the accuracy of the parameters of the regression equation; basic prerequisites for the proper application of the classical regression models; The fundamental concepts of geo-Informatics; theoretical aspects associated with the I/O performance, storage and processing of spatial information using GIS technologies; information system model spatial objects; methods and peculiarities of modeling of spatial information in geographic information system. *Skill:* Carry out an economic analysis of the industry as a whole in terms of knowledge about the profession to discuss the relevant conditions. Investigate and disclose the nature of the economy. Interpretation of intellectual law, applying them to specific legal situations. Apply basic knowledge it to the investigation of economic relationships and processes, and also understand the econometric methods, approaches, ideas, results and conclusions met in the majority of economic books and articles; Use the skills to work with information from various sources to solve professional problems, to evaluate the effectiveness of GIS in solving geographical problems.	
PC-2 meaningful use of knowledge, taking into account the specifics of a particular situation in design, support and development of industrial information systems (ready to apply fundamental engineering knowledge and taking	The ability to solve problems in various programming languages on the topics covered during the semester, as the fastening material, and also on topics not previously covered, as knowledge of programming. Knowledge on programming, development of algorithms of different programming problems for industrial information systems.	**9. Educational practice** **Practice Training**

into account national specifics, technical standards and professional standards);	The ability to test the developed software and making proposals for their implementation directly in production. Knowledge structures of enterprises and their departments, principles of management and work organization in the enterprise; knowledge of methods of formulation and solution of production and economic challenges in the conditions of formation of market economy. Practical skills: in information technologies at the enterprises for processing of information; methods of designing and developing software in the computer center of the enterprise; the maintenance and operation of information systems used in the enterprise, and in the selection of materials, production and managerial skills.	
CC-5 compliance with laws and regulations (the willingness to comply with all legal standards and requirements, including with regard to health and safety compliance in the management of engineering activities).	Knowledge of state policy and fundamental achievements of the Republic of Kazakhstan in the field of physical culture and sports. Knowledge of the theoretical, methodological, hygienic and organizational foundations of physical culture and sports. The ability to use in practical life skills, ensuring the preservation and strengthening of health, development and improvement of psycho-physical abilities and qualities. Ownership experience in the use of means of physical culture and sport for disease prevention, mental well-being, development and improvement of qualities and personality traits.	**10. Additional Types of Learning**

Modules, practice	Expected results	Discipline	Activities	Technologies and methods of forming	Monitoring and evaluation tools
1.GENERAL EDUCATION Compulsory Component (21 credits)	*Knowledge:* The basic stages of the recent history of progressive development of statehood of Kazakhstan (1991-2014.) in the context of the world and Eurasian history.The ability to interpret and creatively use a scientific-historical and philosophical knowledge to summarize the success factors of Kazakhstan's model of development on the way to held the state the Republic of Kazakhstan. Competent use of language and of linguistic and cultural knowledge to solve problems of communication in multilingual and multicultural society of the Republic of Kazakhstan and in the international arena. The of automated data processing; appointment, composition, basic characteristics of computer and office equipment, basic methods and means of processing, storage, transmission and accumulation of information, purposes and principles of the use of application and system software; technology-information search on the Internet, key threats and methods of information security, principles of information protection from unauthorized access, legal aspects of using information technologies and software. Define the main tendencies in the field of information communication technologies; to know what economic and political factors promoted development of information communication technologies; to know architecture, to be able to calculate and evaluate performance measures of supercomputers; to know features of different operating systems. *Skill:* In modern conditions to implement the study of the history of the state and of law, based on research experience and knowledge in order to recreate an objective picture of the history of the state and the law of the country; Speaking: express their thoughts and to speak in a foreign language, respectively, speech language standards, ask questions and answer them,	The modern history of Kazakhstan Kazakh (Russian) Language Foreign Language Philosophy ICT technologies	lecture, seminar, laboratory classes IWS	lecture; discussions, discussions, debates; auditory means; reports and communications	the written exam; tests (closed, open); Midterm Control;

	hold a conversation in a foreign language in the volume of the studied subjects, consuming adequate communication cues to convey the contents read, heard. Develop and defend their own scientific positions; to decide the theoretical and methodological issues in the branch of science. Use information resources for search and information storage; to apply methods and means of information protection; to project and create simple web sites; to make processing of vector and bitmap images; to use different forms of e-learning for extension of professional knowledge; to use different cloud services.				
2. BASIC DISCIPLINES Compulsory Component (20 credits)	*Knowledge:* Modern vocabulary and terminology in English for technology and project management methodology, project management processes, modern software project management. The mathematics: concepts and principles in mathematics; differential and integral calculus, linear algebra, probability theory, statistics, optimization methods, the acquisition of skills in the use of mathematics for modeling in industrial information systems. Essence of the basic concepts, laws and theories of classical and modern physics in their internal relationships and integrity; hierarchy of physical laws and concepts, the boundaries of their applicability, allowing to use them effectively in specific situations; to simulate the physical situation of the computer; carrying out experimental research and processing of results, the ability to allocate physical content in applications of the future specialty. The probabilistic and statistical concepts, simple probability and its estimation; random variable, its numerical characteristics and their evaluation; basic assessment methods. The fundamental principles of algorithm design: divide and conquer techniques, graph algorithms, data structures (heap, hash tables, search trees); modern technologies of constructing algorithms based on structures of the used data and the computer systems for industrial information systems. The principles underlying layered systems architectures and their application to both computers and networks; differences and similarities between the core elements of an IT infrastructure solution, such as clients,	Professionally-Oriented Kazakh (Russian)Language Professionally-Oriented Foreign Language Physics Mathematic I Mathematic II Mathematic III Algorithms, data structures and programming IT infrastructure	lecture, seminar, laboratory classes IWS	lecture; discussions, discussions, debates; auditory means; reports and communications	the written exam; tests (closed, open); Midterm Control;

	servers, network devices, wired and wireless network links, systems software, and specialized security devices; role of IT control and service management frameworks in managing industrial information systems; analyze and understand the security and business continuity implications of IT How IT infrastructure components are organized into infrastructure solutions in industrial information systems; configure an IT infrastructure solution for a small organization, including a network based on standard technology components, servers, security devices, and several different types of computing clients. *Skill:* Apply organizational project management tools to determine the hierarchical structure of the project works, use of formal methods of evaluating the time and resources of the project objectives, determine the amount and sources of funding, to plan and to consider the risks. Generalized solutions of typical problems (theoretical and experimental and practical learning tasks) from different areas of physics as the basis of decision of professional problems. Simulate the physical situation of the computer. The ability to apply in practice, numerical methods differentiability and integrability. Get the practical skills to apply differential and integral calculus in problems of mechanics and physics. Skillful use of regression analysis. To be able to use the correlation analysis of random processes. To construct efficient algorithms and implement them in programming languages; to carry out the lexical analysis, parsing, effective implementation of the software. Apply the core concepts underlying IP networks to solve simple network design problems, including IP subnetting. Analyze and understand the security and business continuity implications of IT infrastructure design solutions.				

3. MAJORS Compulsory Component (5 credits)	*Knowledge:* How and why information systems are used today; the technology, people, and organizational components of industrial information systems; how businesses are using industrial information systems for competitive advantage vs. competitive necessity; the value of information systems investments as well as learn to formulate a business case for a new industrial information system, including estimation of both costs and benefits; the major components of an industrial information systems infrastructure; how various types of information systems provide the information needed to gain business intelligence to support the decision making for the different levels and functions of the organization. The role of databases and database management systems in managing organizational data and information; the basics of how data is physically stored and accessed; design high-quality relational databases; the purpose and principles of normalizing a relational database structure; implement a relational database design using an industrial-strength database management system, including the principles of data type selection and indexing; the data definition, data manipulation, and data control language components of SQL in the context of one widely used implementation of the language; the concept of database transaction and apply it appropriately to an application context; the basic mechanisms for accessing relational databases from various types of application development environments; the role of databases and database management systems in the context of industrial information systems; the key principles of data security and identify data security risk and violations in data management system design. *Skill:* Confidently own methods of statistical data analysis, methods of regression and correlation analysis, numerical methods of statistical data processing. To possess the basic techniques of the analysis of economic and technical information with modern technologies from Microsoft, Oracle and Intel. The of identifying organizational information requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational data models and verifying its structural characteristics with normalization techniques, and implementing and utilizing a relational database using an industrial-strength database management system.	Fundamentals of Information Systems Database in IS	lecture, seminar, laboratory classes IWS	lecture; discussions, discussions, debates; auditory means; reports and communications	the written exam; tests (closed, open); Midterm Control;

4. GENERAL EDUCATION Elective Course (7 credits)	*Knowledge:* The of programming paradigms, syntax and semantics of programming languages, basic models, approaches and techniques of programming; basic structures of programming languages for writing algorithms, types, and data structures; technology design and development industrial information systems; software architecture. Principles of designing and functioning serial technical and program-technical automation, the structure and functional the software of industrial information systems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Understand how technologies are increasing the ability of organizations to globalize business processes and to extend their reach to global customers. *Skill:* Elect technical and program-technical means for creation of ACP and ACS, to execute design layout, technical and program-technical means of automation. Design and development industrial information systems;	Programming Fundamentals of automation and control	lecture, seminar, laboratory classes IWS	lecture; discussions, discussions, debates; auditory means; reports and communications	the written exam; tests (closed, open); Midterm Control;
5. BASIC DISCIPLINES Elective Course (49 credits)	Knowledge: The fundamentals and applications of digital electronics and microprocessors. On service, analysis and improvement of industrial information systems. The of principles of theory of circuits and electrical machines. Applied knowledge of electrotechnology. The of principles of design and development of microprocessor-based automation and control systems with the use of modern tools for industrial information systems. The of modern methods of digital signal processing (modeling of time series, the theory of discrete linear systems, an adaptive interference suppression and spectral analysis). *Skill:*	Industrial Computing Microcontrollers Industrial Production Systems Continuous and digital control Programming Web Applications IIS	lecture, seminar IWS	lecture; the decision of the same task in several alternative ways; the selection of the optimal one on the basis of reasoned discussion.	the written exam; tests (closed, open); Midterm Control solving problems

	Developed computational algorithms and programs the implementation of which is based on universal microprocessors and modern instrumental systems programming for industrial information systems. Organize and plan in the field of the company, and other institutions and organizations. Solve the coupling problem of automated control systems and mathematical, physical, chemical, biological process models. Applied knowledge of industrial computing and communications. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Handle specifications, regulations and mandatory rules. Alleged affiliation: independent custom development; companies that develop software; large organizations that are developing or modifying software for industrial information systems.				
	Knowledge: The subject of operations research and its methodology, elements of convex analysis, basic problems of mathematical programming, convex programming, linear programming problems. Knowledge of the basic concepts and statements of simulation theory for industrial information systems. The basic approaches and methods used in the simulations of telecommunication networks and systems. The basic methods and algorithms for constructing artificial intelligence systems, control systems, fuzzy logic, expert systems and neural network control systems. The principles of modern organization of databases and database systems, basic categories and concepts of databases; different models of data presentation; methods of database design, advanced data processing technologies in industrial information systems. *Skill:* Successfully applied setting skills of optimization problems of the economy, logistics, inventory management theory, scheduling theory. To be	Operations Research and Methods of Optimization Industrial Simulation Techniques Data mining	lecture, seminar laboratory classes IWS	lecture; group mini-projects; individual practice-oriented projects laboratory and practical work	the written exam; tests (closed, open); Midterm Control the solution of problems; the Colloquium;

	able to use numerical methods for solving optimization problems, problems of modeling of economic, administrative processes, monitoring processes, customer service. Design the industrial information model specific system and method of protection, the use of modern programming languages, data processing, and use advanced features to protect networks and operating systems and their analysis. Development of the large amount of information; simulation models in GPSS programming environments, MATLAB. Setting skills of experimental research for the solution of scientific research tasks in the field of telecommunication networks and systems. Explore DWH and OLAP, and devise efficient and cost effective methods for maintaining DWHs. Select and apply proper data mining algorithms to build analytical applications.				
	Knowledge: Basic knowledge of production and manufacturing systems. Capacity for management of the activities covered by the engineering projects. About occupational health and safety, prevention of occupational hazards and safety in machines, according to the current legislation on passive and active protection on fires, and aspects of noise pollution. Basic technical and economic requirements for automation using tools of ERP systems; organization and management of the development process, implementation and support of ERP systems. Automatic regulation and control techniques and its application to industrial automation. In basic and technological subjects, which will enable them to learn new methods and theories, and give them the versatility to adapt to new situations. The basic techniques of designing the architecture of corporate industrial systems based on programming techniques; the basic elements of the theory of industrial systems, templates, design and administration of industrial	Business II Industrial System Analysis and Design IIS audit and control Process Monitoring and control IIS Strategy, Management, Acquisition and Ecology Enterprise Architecture and ERP-system	lecture, seminar laboratory classes IWS	lecture; group mini-projects; individual practice-oriented projects laboratory and practical work	the written exam; tests (closed, open); Midterm Control the solution of problems; the Colloquium;

	information systems based on Share Point technology. Know the basics of programming networking and remote access to the ERP-system. *Skill:* Use contemporary CASE tools for the use in process and data modeling. Design high-level logical system characteristics (user interface design, design of data and information requirements). Ability to organize and plan in the field of the company, and other institutions and organizations. Apply information to the needs of different industries and areas. Be able to apply the skills of information systems software, remote access to the corporate system. Apply microprocessor based multi-function relays on protection of various power system equipment and apparatus.				
	Knowledge: Understand the various functions and activities within the industrial information systems area, including the role of IT management and the CIO, structuring of IS management within an organization, and managing IS professionals within the firm. Understand a variety of frameworks for enterprise architecture analysis and decision making. Understand the concepts of user differences, user experience and collaboration as well as how to design contextually. *Skill:* Ability to handle specifications, regulations and mandatory rules. Design and development of information security management system and the organization of production safety. Analyze the system of information security organization and production. Apply core program control structures. Apply contemporary techniques to evaluate computer interfaces.	Information Security Management in the IIS IIS deployment and maintenance	lecture, seminar laboratory classes IWS	lecture; group mini-projects; individual practice-oriented projects laboratory and practical work	the written exam; tests (closed, open); Midterm Control the solution of problems; the Colloquium;
6. MAJORS Elective Course (10 credits)	*Knowledge:* On business, management, finances, economics and marketing. Business analysis knowledge	Electronic, Sensors, Actuators and Metrology	lecture, seminar laborator	lecture; group mini-projects; individual	the written exam; tests (closed, open);

	The company concept, institutional and legal framework of the company. Understand the challenges and risks concerning business process outsourcing, especially those dealing with ethnic cultural differences from offshore engagements. Knowledge of the fundamentals of electronics. Understand the foundations of project management, including its definition, scope, and the need for project management in industrial information systens Manage project quality, including the identification of the threats to project quality, techniques for measuring project quality, and the techniques for ensuring project quality is achieved. Basic methods and algorithms for constructing artificial intelligence systems, control systems, fuzzy logic, expert systems and neural network control systems. *Skill:* Develop methods and algorithms to solve them; has mastered the principles of electrical circuits containing semiconductor devices. Generalized solutions of typical problems (theoretical and experimental and practical learning tasks) from different areas of Theory of Electrical Circuits as the basis of decision of professional problems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Simulate simple business processes and use simulation results in business process analysis. Development and operation of control systems having elements of artificial intelligence. Apply new methods to solve problems in their area of concern. Make a comparative analysis and artificial intelligence to justify the choice of language. Manage project risk, including the identification of project risk, and the techniques for ensuring project risk is controlled.	Business I IIS Project Management	y classes IWS	practice-oriented projects laboratory and practical work; case study-project	Midterm Control; course work;

7. Individual educational trajectories (IET) (15 credits) **Development IIS**	*Knowledge:* Basic concepts and definitions of object-oriented programming, a methodological framework for building software industrial information systems. Principles, techniques of building software systems for industrial information systems. Basic concepts of real-time systems, models and methods of real-time systems developing. Functions, classification of artificial intelligence systems; fundamental principles for the development of artificial intelligence systems; current trends in the field of artificial intelligence. Principles and applications of robotic systems in industry. General principles of software development in the development of complex software and software intensive systems; methods and techniques for software management, and also to be able to use these in industrial information systems; master general principles and techniques for dealing with quality attributes for various types of software industrial information systems (e.g. security and reliability). *Skill:* Apply general principles of software development in the development of complex software and software intensive systems. Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering. Transcend cultural, social and financial differences and work in international teams, proactively plan and manage one's future career, as well as personal development. Be able to carry out development and debugging of programs written in Prolog using basic structures and methods of logic programming, develop a simple database, the decision tree.	OOProgramming IIS software engineering Real Times Systems Artificial Intelligence Robotic systems	lecture, seminar laboratory classes IWS	lecture; group mini-projects; individual practice-oriented projects laboratory and practical work; the case study project;	the written exam; tests (closed, open); Midterm Control;

7. Individual educational trajectories (IET) (15 credits) **Service IIS**	*Knowledge:* Principles, models and methods of business process management. Principles of modern organization of databases and database systems, basic categories and concepts of databases; different models of data presentation; methods of database design and administration for industrial information systems. Standards of information systems service, using these standards for service of industrial information systems. The cloud technologies for the using in industrial information systems. The tools for the development of networks and Internet use, as well as hardware specific to home networks and networks of small businesses. *Skill:* Applied knowledge of business process management with software tools. Administration and monitoring local computer networks, which are considered the key principles underlying the basis of the routing, remote access, addressing and network services. To able make and solve questions of IIS service via using of standards.	Business Process Management Database Administration Network administration Standards of IIS service Cloud technology	lecture, seminar laboratory classes IWS	lecture; group mini-projects; individual practice-oriented projects laboratory and practical work; the case study project;	the written exam; tests (closed, open); Midterm Control;
8. Interdisciplinary disciplines (2 credits)	*Knowledge:* The role of entrepreneurship in economic development. Basic forms and types of businesses. Planning framework, organization and management of the enterprise. Culture and ethics of the entrepreneur. Competence in the design of mechanisms for the management of the company, the understanding of innovation processes prevailing in the company. The basic concepts of project management in industrial information systems.foundations of statistical estimation and analysis of the accuracy of the parameters of the regression equation; basic prerequisites for the proper application of the classical regression models. The fundamental concepts of geo-Informatics; theoretical aspects associated with the I/O performance, storage and processing of spatial information using GIS technologies; information system model spatial objects; methods and peculiarities of modeling of spatial information in geographic information system. *Skill:*	Innovative Entrepreneurship (by Industry) Intellectual Rights Econometrics Accounting and Audit Geoinformatics Latin Culture of Speech and Language Communication	lecture, seminar	lecture; group mini-projects; individual practice-oriented projects practical work; the case study project;	the written exam; tests (closed, open); Midterm Control;

	Carry out an economic analysis of the industry as a whole in terms of knowledge about the profession to discuss the relevant conditions. Investigate and disclose the nature of the economy. Interpretation of intellectual law, applying them to specific legal situations. Apply basic knowledge it to the investigation of economic relationships and processes, and also understand the econometric methods, approaches, ideas, results and conclusions met in the majority of economic books and articles. Use the skills to work with information from various sources to solve professional problems, to evaluate the effectiveness of GIS in solving geographical problems.	Al-Farabi and Modernity			
9. Educational practice **Practice Training**	The ability to solve problems in various programming languages on the topics covered during the semester, as the fastening material, and also on topics not previously covered, as knowledge of programming. Knowledge on programming, development of algorithms of different programming problems for industrial information systems.	Educational Practice	Practice	individual assignment for algorithm development and programming	defense of report on practice
	The ability to test the developed software and making proposals for their implementation directly in production. Knowledge structures of enterprises and their departments, principles of management and work organization in the enterprise; knowledge of methods of formulation and solution of production and economic challenges in the conditions of formation of market economy. Practical skills: in information technologies at the enterprises for processing of information; methods of designing and developing software in the computer center of the enterprise; the maintenance and operation of information systems used in the enterprise, and in the selection of materials, production and managerial skills.	Practice Training 2 course Practice Training 3 course Practice Training 4 course	Practice	individual assignment for algorithm development and programming	defense of report on practice
10. Additional Types of Learning	Knowledge of state policy and fundamental achievements of the Republic of Kazakhstan in the field of physical culture and sports. Knowledge of the theoretical, methodological, hygienic and organizational foundations of physical culture and sports. The ability to use in practical life skills, ensuring the preservation and strengthening of health, development and improvement of psycho-physical abilities and qualities.	Physical culture	classes	sports section;	commissioning standards;

	Ownership experience in the use of means of physical culture and sport for disease prevention, mental well-being, development and improvement of qualities and personality traits.				

EDUCATIONAL PROGRAM

EDUCATIONAL PROGRAM IN ENGLISH "INDUSTRIAL INFORMATION SYSTEMS"
THE SPECIALITY 5B070300 - INFORMATION SYSTEMS

Academic degree: Bachelor of Technics and Technologies on specialty information systems

Name of modules	Discipline code	Names of disciplines (modules) and types of activities	Credit	ECTS	Lec/prac/ Lab.	Sem.
1. GENERAL EDUCATION						
1. GE Compulsory Component (21 credits)		The Modern History of Kazakhstan	3	5	2+1+0	1
		Kazakh (Russian) Language	3	5	0+3+0	1
			3	5	0+3+0	2
		Foreign Language	3	5	0+2+1	1
			3	5	0+2+1	2
		Philosophy	3	5	2+1+0	4
		ICT Technologies	3	5	2+1+0	2
2. BASIC DISCIPLINES						
2. BD Compulsory Component (20 credits)		Professionally-Oriented Kazakh (Russian)Language	2	4	0+2+0	3
		Professionally-Oriented Foreign Language	2	4	0+1+1	4
		Physics	2	4	1+1+0	1
		Mathematic I	3	5	2+1+0	1
		Mathematic II	2	5	1+1+0	2
		Mathematic III	3	5	2+1+0	3
		Algorithms, Data structures and Programming	3	5	2+0+1	2
		IT Infrastructure	3	5	2+0+1	5

3. MAJORS						
3. M Compulsory Component (5 credits)		Fundamentals of Information Systems	2	4	1+0+1	4
		Database in IS	3	5	2+0+1	5
4. GENERAL EDUCATION (University component) (7 credits)						
4. GENERAL EDUCATION (University component) (7 credits)		Programming	4	6	2+1+1	1
		Fundamentals of automation and control	3	5	2+1+0	3
5. BASIC DISCIPLINES (University component) (49 credits)						
5. BASIC DISCIPLINES (University components) (49 credits)		Industrial Computing	3	5	2+0+1	3
		Microcontrollers	3	5	2+0+1	4
		Industrial Production Systems	3	5	2+0+1	4
		Continuous and digital control	3	5	2+0+1	4
		Programming Web Applications IIS	3	5	2+0+1	5
		Operations Research and Methods of Optimization	3	5	2+1+0	3
		Industrial Simulation Techniques	3	5	2+0+1	5
		Data mining	3	5	2+0+1	7
		Business II	3	5	1+1+0	4

		Industrial System Analysis and Design	3	5	2+0+1	5
		IIS audit and control	3	5	2+0+1	6
		Process Monitoring and control	3	5	2+0+1	6
		IIS Strategy, Management, Acquisition and Ecology	4	6	2+1+1	7
		Enterprise Architecture and ERP-system	3	5	2+0+1	7
		Information Security Management in the IIS	3	5	2+0+1	6
		IIS deployment and maintenance	3	4	2+0+1	7
6. MAJORS (University component) (10 credits)						
6. MAJORS (University component) (10 credits)		Electronic, Sensors, Actuators and Metrology	4	6	2+2+0	2
		Business I	4	6	2+2+0	3
		IIS Project Management	2	4	1+0+1	6
7. Individual educational trajectories (IET) (15 credits)						
IET 1 Development IIS		OOProgramming	3	5	2+0+1	5
		IIS software engineering	3	5	2+0+1	6
		Real Times Systems	3	5	2+0+1	6
		Artificial Intelligence	3	5	2+0+1	7
		Robotic systems	3	5	2+0+1	7
IET 2 Service IIS		Business Process Management	3	5	2+0+1	5
		Database Administration	3	5	2+0+1	6

		Network administration	3	5	2+0+1	6
		Standards of IIS service	3	5	2+0+1	7
		Cloud technology	3	5	2+0+1	7
8. Interdisciplinary disciplines (2 credits)						
8. Interdisciplinary disciplines (2 credits)		Innovative entrepreneurship (by industry)	2	3	1+1+0	6
		Intellectual rights	2	3	1+1+0	6
		Econometrics	2	3	1+1+0	6
		Accounting and audit	2	3	1+1+0	6
		Geoinformatics	2	3	1+1+0	6
		Latin	2	3	1+1+0	6
		Culture of Speech and Language Communication	2	3	0+2+0	6
		Al-Farabi and Contemporaneity	2	3	1+1+0	6
Total theoretical training 129 credits						
9. Practice	**Professional practice (by types of practice)**		**Credit**	**ECTS**	**Week**	**Sem.**
		Educational Practice	2	1	1	2
		Practice Training	1	2,5	2.5	4
		Practice Training	1	2,5	2.5	6
		Practice Training	5	12.5	10	8
		Pre-diploma Practice	2	7,5	5	8
10. Final Certification	8.1	Final examination	1			8
	8.2	Writing and Presentation of Diploma Thesis	2	4,5	4	8
11. Additional Types of Learning		Physical Education	8	8	(0+0+2)	1,2,3,4

Total	**151 credits**

LEARNING UNITS OF SUBJECTS

1. GENERAL EDUCATION

THE MODERN HISTORY OF KAZAKHSTAN

Learning Units:

1. Kazakhstan on the way to Independence: the phase of development and nation-building ideas
    - 1.1. Socio-economic situation in Kazakhstan - preconditions struggle for independence.
    - 1.2. The origins of the national movement of the Kazakh people.
    - 1.3. The historical origins of the formation of the Soviet Kazakhstan: challenges indigenization.
    - 1.4. Formation of the Soviet totalitarian Kazakhstan: character, actions and consequences.
    - 1.5. The exploits and the loss of Kazakhstan in the fight against fascist aggression.
2. The contradictions and consequences of Soviet reforms in Kazakhstan in the second half of the XX century.
    - 2.1. Apogee «cult of personality» and the influence of the «thaw» in the socio-political sphere.
    - 2.2. Socio-economic and spiritual «stagnation» Ecological problems of Kazakhstan.
    - 2.3. Attempts to "perestroika" Soviet Kazakhstan.
    - 2.4. State strategy and socio-economic development of independent Kazakhstan.
    - 2.5. Formation of government of the Republic of Kazakhstan.
    - 2.6. Kazakhstan model of economic development.
    - 2.7. Social reforms and changes in the field of education.
    - 2.8. Ethnodemographic processes and strengthening of interethnic consent.
3. A democratic and spiritual renewal of independent Kazakhstan.
    - 3.1. Social and political prospects.
    - 3.2. The youth policy in the Republic of Kazakhstan and define the path of spiritual renewal.
    - 3.3. Policy formation of a new historical consciousness and outlook of the people of the Great Steppe.
4. The value of the Leader of the nation program "People in the stream of history" for the formation of a new historical consciousness.
5. The significance of the celebration of 550 anniversary of the Kazakh Khanate for the formation of a new social consciousness.
6. «Mangilik El» - Kazakhstan national idea of the XXI century.
7. Kazakhstan - a country recognized by the modern world.

KAZAKH (RUSSIAN) LANGUAGE

Learning Units:

1. Introductory course: language and speech. The main functions of language.
    - 1.1. Language and its basic functions. Speech: types and forms of speech. General characteristics of the forms and types of speech.
    - 1.2. Text as the leading unit of verbal communication. The main features of the text. Methods of communication proposals in the text.
    - 1.3. Functional-semantic types of speech. Understanding the types of monologue speech.

1.4. Functional styles of speech. General characteristics of functional speech styles.

1.5. Conversational style. Art style. Journalistic style. Official-business style.

1.6. Style and language features. The main genres of documentation. Preparation of documents: autobiography, resume, declarations, powers of attorney, receipts, reports and others.

1.7. Scientific style and its features. Stylistic features of scientific style. Lexical and grammatical means of scientific style.

2. Structural-semantic division of scientific text.

2.1. Types of scientific information, incorporated in the text.

2.2. Definition: general characteristics. Introduction of the term.

2.3. Features more information text (summarizing, concretizing illustrating opening, the substitute).

2.4. Communicative situation scientific field of communication.

3. The culture of professional speech. Scientific discussion

3.1. Oral scientific speech. Information genres: abstract, message, lecture, report. The structure of the oral monologue. Performing with elements dialogization: the question of the author - the answer to it, dialogized monologue - the interaction with the audience, the inclusion of students in the monologue.

3.2. Convincing genres in scientific and journalistic style. Discussion. Dispute. Controversy. The objectives of the discussion of communication. Voice actions involved in the discussion dealing.

FOREIGN LANGUAGE

Learning Units:

1. Higher education in Kazakhstan. The system of education in Great Britain and in the USA. My university. My future speciality.
2. Environmental problems.
3. Electricity. Non-traditional sources of energy.
4. Electronics. Television.
5. Computers.
6. New technological achievements in new materials production.
7. Made in Space. Transport for tomorrow.
8. A New Era for Aircraft.
9. Water transport.
10. Technological and scientific achievements.
11. Optical technology and laser application.
12. Superconductivity.
13. The International Space Station.

PHILOSOPHY

Learning Units:

1. The subject of philosophy.
2. Subject matter, purpose and function of philosophy.
3. History of philosophy
4. The philosophy of the ancient world.
5. The philosophy of the Middle Ages of the East and the West
6. Renaissance Philosophy
7. The philosophy of the New Age
8. The philosophy of the European Enlightenment of the XVIII century.
9. Classical German Philosophy.
10. The philosophy of the end of the eighteenth century - beginning of the XXI century.
11. Kazakh philosophy.
12. Basics of philosophical understanding of the world.
13. Being as the central category of ontology.
14. Development principle: dialectics and synergy.
15. Possibilities and boundaries of knowledge. The specificity of scientific knowledge.
16. Philosophy in the search and development.
17. Philosophical anthropology.
18. Social philosophy.
19. Philosophical understanding of today's global challenges.

INFORMATION AND COMMUNICATION TECHNOLOGIES

Learning Units:

1. The role of ICTs in key sectors of society. ICT Standards.
2. Introduction into computer systems. Architecture of computer systems.
3. Software. OS.
4. Human-computer interaction.
5. Database systems.
6. Data analysis. Data management.
7. Networks and Telecommunications.
8. Cyber security.
9. Internet technologies.

10. Cloud and Mobile technologies.
11. Multimedia technologies.
12. Smart technology.
13. E-technology. E-business. E-learning. E-government.
14. Information technology in the professional sphere. Industrial ICT.
15. ICT Development Prospects

2. BASIC DISCIPLINES

PROFESSIONALLY-ORIENTED KAZAKH (RUSSIAN) LANGUAGE

Learning Units:

1. Introduction
    - 1.1. Introduction to the subject area on the professional Kazakh (Russian) language.
    - 1.2. Foundations for mastery of subject-language material.
    - 1.3. Basic categorical and conceptual apparatus in his professional Kazakh (Russian) language.
    - 1.4. Professional terminology in Kazakh (Russian) language.
    - 1.5. Feature content domain majoring in Kazakh (Russian) language.
2. Simulation of random laws.
    - 2.1. Simulation of random numbers.
    - 2.2. Simulation of random events.
    - 2.3. Simulation of continuous random variables.
    - 2.4. Simulation of random vectors.
    - 2.5. Modeling of random processes and flow requirements.
    - 2.6. Identification of the random laws.
3. Simulation models of information processes.
    - 3.1. Organization simulation.
    - 3.2. Simulation of queuing systems and Petri nets.
    - 3.3. Physical modeling.
    - 3.4. Simulation modeling of economic and organizational systems.
    - 3.5. Simulation modeling of management information systems.

PROFESSIONALLY-ORIENTED FOREIGN LANGUAGE

Learning Units:

1. Introduction.

1.1. Introduction to the subject area of specialty in the professional foreign language.
1.2. Professional foreign language disciplinary phenomenon, serving all areas of human activity.
1.3. Terminology, Lexicology of foreign languages. History of project management development.

2. Project Life Cycle and Organization project.
2.1. Summary of project management.
2.2. Case classification projects.
2.3. Project Life Cycle.
2.4. Group management processes: initiation, planning, monitoring and management, execution, completion.

3. Project Integration Management.
3.1. The stages of project planning.
3.2. Structural hierarchical decomposition of the work.
3.3. Control the timing and cost of the project.
3.4. Project Quality Management.
3.5. Management of human resources and communications.

4. Risk Management and Project Procurement.
4.1. Identification of risks, risk response planning, project risk management.
4.2. Project Procurement Management.
4.3. Documentation, completion of the project.
4.4. Trends in the development of project management theory.
4.5. The use of special terminology, the vocabulary of the English language in the project management of information systems in science, technology and business.

PHYSICS

Learning Units:

1. Mechanics
1.1. Physics and measurement. Kinematics. Basic formulations and laws of body movement. Motion in one and several dimensions. Distance, velocity, acceleration and their relations
1.2. Circular motion and other applications of Newton’s Laws

2. Dynamics
2.1. Energy of a system. Conservation of energy
2.2. Linear momentum and collisions. Rotation of a rigid object about a fixed axis. Angular momentum.
2.3. Static equilibrium and elasticity. Universal gravitation.
2.4. Oscillations and mechanical waves

2.5. Oscillatory motion. Wave motion.
2.6. Sound waves. Superposition and standing waves.

3. Molecular physics and thermodynamics
   3.1. Temperature. The first law of thermodynamics.
   3.2. The kinetic theory of gases. Heat engines, entropy and the second law of thermodynamics.
4. Electricity and magnetism
   4.1. Electric field. Gauss's law. Electric potential.
   4.2. Capacitance and dielectrics. Current and resistance.
   4.3. Direct current circuits.
   4.4. Magnetic field. Sources of magnetic field.
   4.5. Faraday's law. Inductance.
   4.6. Alternating current circuits. Electromagnetic waves.
5. Optics
   5.1. Wave equation for the electromagnetic field
   5.2. Properties of light waves
   5.3. Diffraction of waves
6. Quantum physics
   6.1. Thermal radiation. Experimental substantiation of basic ideas of quantum theory.
   6.2. Elements of quantum physics.

ALGORITHMS, DATA STRUCTURES AND PROGRAMMING

Learning Units:

1. Introduction. Course overview.
2. C++. Basic goals and concepts.
3. Object oriented programming. Encapsulation. Inheritance. Polymorphism.
4. Programming Skills. Debugging, testing, application of OO concepts.
5. Basic data structures. Stacks, queues, linked lists.
6. Algorithm analysis.
7. Recursion.
8. Sorting. Mergesort, quicksort, bin sort, heap sort.
9. Trees. Traversal. Binary search trees.
10. Hash Tables.
11. Balanced Trees. Splay trees. AVL trees. Red-Black trees. B Trees. Union-Find trees.

12. Priority Queues. Binary heaps.
13. Graphs. Graph algorithms.

IT INFRASTRUCTURE

Learning Units:

1. Core computing system architecture concepts
2. Core computing system organizing structures
3. Core technical components of computer-based systems
4. Role of IT infrastructure in a modern organization
5. Operating systems
   - 5.1 Core operating systems functionality
   - 5.2 Internal organization of an operating system
   - 5.3 Types of devices that require and use operating systems
   - 5.4 Multitasking and multithreading
   - 5.5 File systems and storage
   - 5.6 User interfaces
   - 5.7 Operating system configuration
   - 5.8 Securing an operating system
   - 5.9 Virtualization of computing services
6. Networking
   - 6.1 Types of networks
   - 6.2 Core network components
   - 6.3 TCP/IP model
   - 6.4 Physical layer: wired and wireless connectivity
   - 6.5 Data link layer: Ethernet
   - 6.6 Network layer: IP, IP addressing and routing
   - 6.7 Transport layer: TCP
   - 6.8 Application layer: core Internet application protocols
   - 6.9 Network security and security devices
   - 6.10 The Internet as a key networking platform
   - 6.11 Network device configuration
7. Data centers
8. Securing IT infrastructure

8.1 Principles of encryption and authentication
8.2 Component level security: clients, servers, storage network devices, data transport, applications
8.3 Perimeter security: firewalls
8.4 Using public networks for secure data transport: VPNs

9. Grid computing
10. Cloud computing, computing as a service
11. System performance analysis and management

3. MAJORS

FUNDEMENTALS OF INFORMATION SYSTEMS

Learning Units:

1. Characteristics of the Digital World
2. Information systems components
   - 2.1 Hardware, software
   - 2.2 Data
   - 2.3 Networks
   - 2.4 Facilities
   - 2.5 Personnel
   - 2.6 Services o Partners
3. Information systems in organizations o Characteristics of IS professionals
   - 3.1 IS career paths o Cost/value information o Quality of information
   - 3.2 Competitive advantage of information
   - 3.3 IS and organizational strategy
   - 3.4 Value chains and networks
4. Globalization
   - 4.1 What is globalization?
   - 4.2 Technology enabled change
   - 4.3 Digital divide
5. Cultural, ethnic, political challenges. Global information systems strategies
6. Valuing information systems
   - 6.1 How information systems enable organizational processes
   - 6.2 Making a business case for information systems
   - 6.3 Productivity paradox of information systems

6.4 Investment evaluation. Multi-criteria analysis
6.5 Cost-benefit analysis o Identifying and implementing innovations

7. Information systems infrastructure
   7.1 Hardware o Software
   7.2 Collaboration and communication technologies
   7.3 Data and knowledge
8. Faculties o Services o Personnel. Partnerships
9. The Internet and WWW
   9.1 E-business. B-to-C. B-to-B o Intranets, Internet, extranets
   9.2 E-government
   9.3 Web 2.0
10. Technologies: e.g., wikis, tags, blogs, netcasts, self-publishing
11. New forms of collaboration: social networking, virtual teams, viral marketing, crowd-sourcing
12. Security of information systems
   12.1Threats to information systems
   12.2Technology-based safeguards
   12.3Human-based safeguards
   12.4Information systems security planning and management
13. Business intelligence. Organizational decision making, functions, and levels
14. Executive, managerial, and operational levels
15. Systems to support organizational functions and decision making o Information and knowledge discovery
16. Reporting systems
17. Online analytical processing
18. Data, text, and Web mining
19. Business analytics o Application systems
20. Executive, managerial, and operational support systems
21. Decision support systems
22. Functional area information systems
23. Collaboration technologies
24. Intelligent systems
25. Knowledge management systems. Information visualization
26. Visual analytics
27. Dashboards

28. Geographic information systems
29. Enterprise-wide information systems
    29.1Enterprise resource planning
    29.2Supply chain management
    29.3Customer relationship management
30. Development and acquisition
    30.1Alternative development approaches
    30.2External acquisition
    30.3Outsourcing
    30.4End-user development
31. Information systems ethics and crime
32. Information privacy, accuracy, property, and accessibility. Computer crime o Cyberwar / cyberterrorism

DATABASE IN IS

Learning Units:

1. Introduction to Databases Traditional File-Based Systems
    1.1 Database Approach
    1.2Roles in the Database Environment
2. Database Environment
    2.1 The Three-Level ANSI-SPARC Architecture
    2.2 Database Languages
    2.3 Data Models and Conceptual Modeling
    2.4 Functions of a DBMS
    2.5 Components of a DBMS
    2.6 Multi-User DBMS Architectures
3. The Relational Model and Languages
    3.1The origins of the relational model.
    3.2The terminology of the relational model.
    3.3The connection between mathematical relations and relations in the relational model.
    3.4 Properties of database relations. How to identify candidate, primary, alternate, and foreign keys. The meaning of entity integrity and referential integrity.The purpose and advantages of views in relational systems.
    3.5 Unary Operations. Set Operations.Join Operations
4 Relational Algebra and Relational Calculus
    4.1 The Relational Algebra

4.2 The Relational Calculus
4.3 SQL: Data Manipulation
4.4 Introduction to SQL
4.5 Data Manipulation
4.6 Sorting Results (ORDER BY Clause)
4.7 Using the SQL Aggregate Functions
4.8 Grouping Results
4.9 SQL Data Types

5. Normalization
5.1 The Purpose of Normalization
5.2 How Normalization Supports. Database Design
5.3 Data Redundancy and Update Anomalies
5.4 Functional Dependencies
5.4.1 Characteristics of Functional Dependencies
5.4.2 Identifying Functional Dependencies
5.4.3 Identifying the Primary Key for a Relation using Functional Dependencies
5.5 The Process of Normalization
5.6 First Normal Form (1NF)
5.7 Second Normal Form (2NF)
5.8 Third Normal Form (3NF)
5.9 General Definitions of 2NF and 3NF

6. Web Technology and DBMSs Semistructured
7. Data and XML

4. UNIVERSITY COMPONENT (GENERAL EDUCATION)
PROGRAMMING
Learning Units:

1. Concept algorithm and their ways of the description.
2. Properties of an algorithm , their constructions. Check of an algorithm and analysis.
3. Ways description of cyclic operators
4. Structure of the program. Language objects. Identifiers. Definition and descriptions of function
5. Types of variables
6. Operators of a cycle While, for, do.. while.
7. Global and local variables

8. Arrays and vectors. Multidimensional arrays
9. Ways sorting of arrays
10. Input-output of multidimensional arrays
11. Symbols and phrases. Input and output.
12. Work with files
13. Work with structures of data on C/C ++
14. The graphic modes on C
15. Change of color of the screen

FUNDAMENTALS OF AUTOMATION AND CONTROL

Learning Units:

1. Introduction to Automation Systems:
   - 1.1 Introduction to Automation: Concepts (open vs closed loop control, ...)
   - 1.2 Main Application Domains: Case Studies
   - 1.3 Functions of automata
   - 1.4 Levels of Automation (automation pyramid)
   - 1.5 System types: discrete event vs. continuous time
2. Analysis and Design of Discrete event systems in the scope of Automation Systems
   - 2.2 State Machines
   - 2.3 Moore and Mealy. Extensions and application examples
   - 2.4 Grafcet: Fundamental concepts (Step, Transition, Condition, Action, Rules of Evolution).
   - 2.5 Study of classic design patterns (concurrency, synchronization, resource sharing and hierarchy).
   - 2.6 Hierachical control (macro-actions and macro-Steps).
   - 2.7 Synchronous and Asynchronous Implementation.
   - 2.8 Petri Nets: Fundamental concepts (place, weighted arc, rules fo evolution, ...)
   - 2.9 Differences and modelling power compared to Grafcet.
   - 2.10 Brief overview of extensions (interpreted, timed, ...)
3. Programmable Logic Controllers (PLCs)
   - 3.1 Physical Architecture (power supply, CPU, I/Os, network interfaces, …)
   - 3.2 Execution mode
   - 3.3 Programming sequential control algorithms using SFC and ST (as defined in IEC 61131-3)
   - 3.4 Programming combinatorial and sequential control algorithms using LD (as defined in IEC 61131-3)
   - 3.5 Program Organization Units and FBD (as defined in IEC 61131-3)

4. Structured design.
    4.1 Introduction: Structuring Needs
    4.2 Cycles of execution: Types
    4.3 Alarm and Alarm Treatment
    4.4 Structured Design: GEMMA Method

5. UNIVERSITY COMPONENT (BASIC DISCIPLINES)
INDUSTRIAL COMPUTING
Learning Units:

1. Introduction to Industrial Informatics
2. Expansion of Programming
3. Interface with the Process
4. Interface with the User
5. System Image
6. Task Sequencing and Control
7. Mircroprocessor Based Systems
8. Industrial Computing Project

MICROCONTROLLERS
Learning Units:

1. Introduction to Microcontroller-Based Systems
2. Applications of Microcontrollers
3. Microcontroller Architecture
4. Programming the Microcontroller
5. Programming Tools
6. Application Development
7. Application of Microcontroller Peripherals
8. Digital input / output
9. Timers
10. Interruptions
11. A / D Conversion

INDUSTRIAL PRODUCTION SYSTEMS

Learning Units:

1. The production function
   1.1 The production function
2. Products and processes
   2.1 Product Design
   2.2 Design and analysis of processes
3. Plant distribution
   3.1 Production Planning
   3.2 Capacity planning
   3.3 Aggregate Planning
   3.4 Production scheduling
   3.5 Planning framework and MRP
4. Production management techniques
   4.1 Stock management
   4.2 Fabrication adjusted

CONTINUOUS AND DIGITAL CONTROL

Learning Units:

1. Automatic control: Signals and systems.
   1.1 Introduction. Automatic control.
   1.2 Basic concepts: Signals and systems.
   1.3 Classification of control systems.
   1.4 General structure of the servo system.
   1.5 The problem of control: Modeling and identification, analysis and design.
2. Modeling of dynamic systems. Representations
   2.1 Introduction. Models of a continuous dynamic system.
   2.2 Laplace transform. Properties.
   2.3 Mathematical representation: Transfer function
   2.4 Dynamic system response to arbitrary input.
   2.5 Graphical representation: Block diagram.
   2.6 Theoretical modeling of linear systems.
   2.7 The problem of linearization.

2.8 Modeling of simple systems.

3. Stability and precision. Analysis and identification of the temporal response.
   3.1 Introduction. Temporary and permanent regime.
   3.2 Absolute and relative stability.
   3.3 Static servosystem accuracy. Servo system type.
   3.4 Fault in disturbances.
   3.5 Systems of first and second order.
   3.6 Systems of higher order. Reduced equivalent system.
4. Graphical analysis of the transient response. The place of the roots
   4.1. Introduction. Design of control systems.
   4.2. The diagram of the place of the roots. Basic layout rules.
   4.3. Module and argument criteria.
   4.4. Interpretation of the place of the roots.
5. Basic control actions. Design and implementation of PID regulators.
   5.1. Introduction. The PID regulator.
   5.2. Basic control actions: Proportional, integral and derivative.
   5.3. Design of PID regulators at the site of the roots.
   5.4. Experimental adjustment of PID controllers. Methods of Ziegler-Nichols.
   5.5. Industrial PID. Practical aspects of implementation

PROGRAMMING WEB APPLICATIONS IIS

Learning Units:

1. The concepts of the method and technology of design software. General characteristics and classification Case-funds. Technology implementation Case-funds. The practical implementation of Case-funds. Evaluation and selection of Case-funds
2. Object-oriented design approach. Summary of the objective approach. The basic concepts of object-oriented analysis, design and programming. Object-oriented analysis and design. An example of object-oriented analysis and design
3. The concept of the software life cycle. The basic processes of software life cycle.
4. The essence of the structural approach. Functional modeling method SADT.
5. Methodology for the design, development and maintenance of information systems applications. MSF Basic principles of application development. The key concept of the MSF Process Model. Model industrial architecture.
6. Model of the project team and the model development process. Model project team. Characteristics of the MSF Process Model. Creation of industrial architecture. Prediction and Response.

7. Process Model MSF. The phases and milestones of the MSF Process Model. Applications enterprise. Features applications. Architecture of industrial applications. Basic principles of application development. Model of industrial applications.
8. Model risk management. Sources of risk. Methods of risk management. Phase "Approval of concept" and its results. Matching concept.
9. The model of the design process. Project plan. Development of the project plan. Phase "Planning" and the design process.
10. Software Engineering. The role of software engineering in system design. The role of the software engineer. Software: the nature and quality. Classification of software quality. Demonstration of quality.
11. The principles of software engineering. The rigor and formality. The division of tasks. Modularity. Abstraction. Commonality. Incremental.
12. Testing and production cycle. Phase stabilization. Recommended methods the MSF Process Model. "
13. User-level technology. Selecting the user interface. Selecting the user level architecture.
14. Data-Tier Technologies. Data Layer. Universal store. Based on the UDA Access Components. Data Modeling.

OPERATIONS RESEARCH AND METHODS OF OPTIMIZATION

Learning Units:

1. The techniques of operations research
2. The basic methods of graph theory
3. The specific formulation and methods for solving linear and mathematical programming
4. The methods for solving linear programming problems
5. The optimality criteria in mathematical programming problems
6. The duality theory and research methods of mathematical programming tasks based on them
7. The numerical methods for solving mathematical programming problems

INDUSTRIAL SIMULATION TECHNIQUES

Learning Units:

1. Definitions, terms and concepts of modeling theory. Modeling principles. Building a computer model.
2. Modeling stages. Computer modeling of mathematical difference.
3. Basics of simulation technology. The concept of static experiment. Scope and classification of simulation models.
4. The behavior of the system. Assessing the adequacy of the system.
5. Simulation of random factors. Methods for generating random numbers. Stochastic Systems.
6. Simulation of random events. Simulation of random variables. The Monte Carlo method.
7. Management model time. Types of presentation time in the model. Changing the time with a constant pitch.
8. Changing the time on special conditions. Simulation of parallel processes. Types of parallel processes. The use of network models to describe parallel processes.

9. Planning model experiment. The goals of experimental design. Strategic planning simulation experiment. Tactical planning of experiment.
10. Processing and analysis of simulation results. Evaluation of the quality of the simulation model. Calibration models.
11. A dynamical system. Time. Space. Developments. Continuous models. Digital display. Finite state machines.
12. Various forms of representation of dynamic systems. Systems with continuous time. The transfer functions.
13. Simulation of queuing systems. Modeling single-channel queuing systems. Simulation of queuing systems with unreliable elements.
14. Simulation of queuing systems with relative priority.

DATA MINING
Learning Units:
1. Decision making and data mining
2. Data models in prediction
3. Prediction with standard functions
4. The coefficient of determination and confidence intervals
5. Methods of data preparing
6. Methods of models evaluation
7. Methods of data smoothing
8. Trend detection
9. Classification and clusterization
10. Decision tree
11. Cluster analyses

BUSINESS II
Learning Units:
1. The economic environment of the company
    1.1 Microeconomic environment
    1.2 Macroeconomic environment
2. The annual accounts of the company. The General Accounting Plan
    2.1 The information generated by financial accounting
    2.2 The balance of the situation and the profit and loss account
3. The analysis of the financial statements
    3.1 Analysis of ratios
    3.2 Economic and financial profitability
4. Sources of funding

4.1 Short-term financing
4.2 Long-term financing

5. Investment analysis
5.1 Static models of investment analysis
5.2 Dynamic models of investment analysis

INDUSTRIAL SYSTEM ANALYSIS AND DESIGN

Learning Units:

1. Identification of opportunities for IT-enabled organizational change
2. Business process management
3. Analysis of business requirements
   3.1. Business process modeling
   3.2. Information requirements
4. Structuring of IT-based opportunities into projects
5. Project specification
6. Project prioritization
7. Analysis of project feasibility
   7.1. Operational
   7.2. Tangible costs and benefits (financial and other measures such as time savings)
   7.3. Intangible costs and benefits such as good will, company image
   7.4. Technical
   7.5. Schedule
   7.6. Legal
   7.7. Cultural (organizational and ethnic)
8. Fundamentals of IS project management in the global context
9. Using globally distributed communication and collaboration platforms
10. Analysis and specification of system requirements
    10.1. Data collection methods
    10.2. Methods for structuring and communicating requirements
    10.3. Factors affecting user experience
    10.4. User interface design
    10.5. System data requirements
    10.6. Factors affecting security

10.7. Ethical considerations in requirements specification

11. Different approaches to implementing information systems to support business requirements
    - 11.1. Packaged systems; enterprise systems
    - 11.2. Outsourced development
    - 11.3. In-house development
12. Specifying implementation alternatives for a specific system
13. Impact of implementation alternatives on system requirements specification
14. Methods for comparing systems implementation approaches
15. Organizational implementation of a new information system
16. Different approaches to systems analysis & design: structured SDLC, unified process/UML, agile methods

IIS AUDIT AND CONTROL

Learning Units:

1. Purpose and value of IS audit and IT governance
2. Organizational Responsibilities
    - 2.1 Executive management
    - 2.2 Auditors
    - 2.3 IT and Information security
    - 2.4 General users
3. Information security
    - 3.1 Three primary goals (confidentiality, integrity, availability)
    - 3.2 Principles: Accountability, Awareness, Ethics, Multidisciplinary,
    - 3.3 Proportionality, Integration, Timeliness, Assessment, Equity
4. Ethics and legal issues
    - 4.1 Agreements for: confidentiality, trade secrets, discovery, non-compete
    - 4.2 Intellectual property and fair use
    - 4.3 Patents, trademarks, and copyrights
5. Audits and Assessments, Major Guidance
    - 5.1 Differences between an audit and an assessment
    - 5.2 Guidance and where each guiding document is applied. GAAP. SAS: SAS 48, SAS 70, SAS 78, SAS 94. COSO
    - 5.3 COBIT. For COBIT, be able to describe and indicate how the following are used: Process objectives, Information criteria, IT Resources,
    - 5.4 Maturity Models, Critical Success Factors, Key goal indicators, Control objectives
    - 5.5 ITIL. ISO17799

6. Risk
    - 6.1 Business risk, audit risk, security risk, continuity risk
    - 6.2 SEI risk statement (two things needed to express risk clearly)
    - 6.3 Components of risk: threat, vulnerability, exposure, impact, consequence
    - 6.4 Risk response options: manage, reduce, transfer, ignore, monitor
    - 6.5 Threat classes: natural, accidental and unintentional, intentional, political unrest, acts of was
    - 6.6 Threat agents, threat agent motives
    - 6.7 Four basic steps to a risk assessment
7. Information security programs
    - 7.1 Relative importance of people, policy, and technology
    - 7.2 Program foundation: policy, education, ownership, defined responsibilities
    - 7.3 Role of risk management in information security programs
    - 7.4 Program components: charter, risk assessment, data management, access management, technical architecture, incident response, DR/BC, physical security, sanction
    - 7.5 Key department relationships and their purpose: human resources, training, risk management, quality management, compliance, executive management
8. Information Security Management
    - 8.1 Supporting role and purpose of: policy, training, culture, baselines, system
    - 8.2 Acquisition and development, change management, configuration
    - 8.3 Management, monitoring, personnel policies, assessments, metrics, and evaluation
    - 8.4 Incident response and basic steps: identification, containment, collection, recovery, analysis
9. Policy, process, and procedure
    - 9.1 Differences between policy, process and procedure
    - 9.2 Purpose of policy, process and procedure
    - 9.3 Be able to identify policy meta-data
    - 9.4 General understanding of what should be addressed by policy:
    - 9.5 Program charter, risk management, acceptable use, data management, physical protection, access management, personnel security, sanction, incident response, IT management
    - 9.6 Preferred / most effective policy authors and creation processes
10. Organization
    - 10.1 Basic job responsibilities of various IT functions, particularly: Programmer, programmer/analyst, systems analyst, database administrator, systems project manager, project manager, quality analyst / tester
    - 10.2 Network administrator, system administrator, voice and data communication analyst, web content administrator

10.3 Webmaster, hardware technician, help desk specialist, security specialist, operator, IS auditor, CIO
10.4 Various ways of organizing an IT department, and advantages and disadvantages
10.5 How size impacts ability to segregate duties

11. Software / System Development Life Cycle
    11.1 Four basic steps in SDLC: analysis, development, testing, implementation
    11.2 General sense for SDLC risks (don't have to know each bullet on slides)
    11.3 Differences between pre- and post- implementation audits
    11.4 Pre-implementation: approaches, role of auditor, advantages, disadvantages
    11.5 Post-implementation: approaches, role of auditor, advantages, disadvantages
12. Application development
    1.1 Architectures and placement of controls
    1.2 Role of databases in control design
    1.3 Database issues
    1.4 Input, output, transaction controls
    1.5 Virus, trap door, Trojan horse, logic bomb, worm
    1.6 Time of check / time of use
13. Networking. Concept of layering (OSI model, TCP/IP – no detail needs to be memorized)

PROCESS MONITORING AND CONTROL

Learning Units:

1. What is a Supervisory Control and Data Acquisition system? History of SCADA
2. SCADA for Industrial Applications. SCADA for Utility Applications. Top SCADA Challenges and Vulnerabilities.
3. Monitoring and Control Mechanisms. SCADA Software and Hardware
4. DCS and SCADA. DDS - Data Distribution Service
5. SCADA Classification. SCADA Components
6. UCA. PLC and Protection Relays. Databases
7. Communication & Protocols
8. Case Study: Industrial Process Automation SCADA System and Security
9. Case Study: SCADA Distribution Automation
10. SCADA Components. Security. Physical Network security
11. Sensors and Sensing. Networks and Topologies. Computations
12. Data Acquisition
13. Substation SCADA System

14. Case Study: Substation Automation SCADA. Establishing a network. Improving performance and reliability. Expanding to regional/WAN network
15. Design and Project Principles. Project life cycle. Installation and retrofit. Commissioning process. Implementation of project management.
16. Testing and Troubleshooting. Disaster recovery. Recovery & emergency plan. System Sectioning. Reliability testing. Cross technology testing
17. Information Management. Alarms. Trending. Reporting. Historical Data Storage. For what purpose. Systems for storage. Retention
18. Additional Systems. Training/Replay simulators. Performance analysis. Smart system feed-ins. Smart system feed-outs

IIS STRATEGY, MANAGEMENT, ACQUISITION AND ECOLOGY

Learning Units:

1. The IS function
2. IS strategic alignment
3. Strategic use of information
4. Impact of IS on organizational structure and processes
5. IS economics
6. IS planning
7. Role of IS in defining and shaping competition
8. Managing the information systems function
   - 8.1 IS leadership: The role of the CIO and IS management
   - 8.2 Structuring the IS organization
   - 8.3 Hiring, retaining, and managing IS professionals
   - 8.4 Managing a mixed set of internal and external resources
   - 8.5 Determining staffing skills allocation models
9. Financing and evaluating the performance of information technology investments and operations
10. Acquiring information technology resources and capabilities
    - 10.1 Acquiring infrastructure capabilities
    - 10.2 Sourcing information systems services
    - 10.3 Sourcing information systems applications
11. Using IS/IT governance frameworks
12. IS risk management
    - 12.1 Managing business continuity
    - 12.2 Managing security and privacy
13. Bases of environmental technologies
14. Atmospheric and acoustic pollution

15. Water Pollution
16. Waste recovery
17. Radioactive pollution
18. Soil contamination and control techniques
19. Assessment of environmental impacts

ENTERPRISE ARCHITECTURE AND ERP-SYSTEM

Learning Units:

1. Service oriented architecture
2. Enterprise architecture frameworks
3. Systems integration
4. Enterprise resource software
5. Monitoring and metrics for infrastructure and business processes
6. Green computing
7. Virtualization of storage and systems
8. The role of open source software
9. Risk management
10. Business continuity
11. Total cost of ownership and return on investment
12. Software as a service
13. Enterprise data models
14. Data / information architecture and data integration
15. Content management
16. Audit and compliance
17. System administration
18. IT control and management frameworks
19. Emerging technologies

IIS INFORMATION SECURITY MANAGEMENT

Learning Units:

1. The concept of information safety .Introduction.
    1.1 Information security concept. The basic components.
    1.2 The importance of information security concept. Information security categories.

1.3 Distribution of object-oriented approach to information security.
1.4 Disadvantages of the traditional approach to information security with the object point of view.
1.5 Information security categories. The methods of stealing information.
1.6 Express -Audit information security

2. Basic information security threats. The most common threat. The main threats to information security. The main threats to information security.
2.1 Security audit of critical processes and services.
2.2 The introduction of the integrity control system and application (migration to alternative solutions other antivirus vendors).
2.3 Implementation privileged user activity monitoring systems on target systems.
2.4 Legislative level of information security. Overview of Kazakhstan's legislation in the field of information security.
2.5 Construction models threats and intruders, information security risk analysis. The introduction of additional authentication systems.
2.6 The introduction of systems to prevent network storm. Safety-critical and fixed systems, automated process control systems (PCS). Security analysis of applications and infrastructure. Scan tools. Implementation of IDS systems.
2.7 The introduction of remote secure access systems. Implementation of the protection system of transmission of unwanted information from the in the subsystem of automated process control systems (PCS) in the overall enterprise information network.
2.8 Security Policy Development of the Information System of the organization and production. Security Procedures Organization.

3. The levels of information security. Procedural level of information security.
3.1 Protection of the information against leakage through technical channels.
3.2 Security Risk Management organization and production.
3.3 Classification of modern symmetric cryptosystems digital signature.
3.4 Data protection from drain through acoustic / acoustoelectric / vibroacoustic communication channels.

4. Basic information security management measures. Software and hardware.
4.1 Basic software and hardware information security management measures.
4.2 Protection of information leakage channels of communication / optical / radio channels / electrical channels.
4.3 RSA cryptosystem signature. EDS El-Gamal. Algorithms implementation.
4.4 Fine-tuning of information security. Logging and auditing, encryption, integrity monitoring.
4.5 The implementation of the algorithm of public key distribution Diffie-Hellman.
4.6 Methods and models of asymmetric cryptosystems electronic digital signature. Digital Signature Algorithm SHA.
4.7 Determination algorithm of symmetric algorithms for digital signature. Digital Signature Algorithm DSA.

5 Network Security and interworking.
5.1 Shielding, protection of network analysis and network infrastructure of the organization.
5.2 Construction of VPN systems, IPS, network control used in applications, building management systems, configuration files of network devices.
5.3 Control used in network applications. The introduction of secure content management systems on the basis of decisions Cisco IronPort Web Security.
5.4 Building Management System configuration files of network devices Web Application Firewall.

5.5 High Availability. The safety of using mobile devices.
5.6 Securing remote access to enterprise resources with mobile platforms:-style encrypted communication channel; authentication when accessing; protection corporate information from further dissemination;

IIS DEPLOYMENT AND MAINTANENCE

Learning Units:

1. The problems of the selection of application software
   1.1 Problems of systems selection.
   1.2 Identification of the needs of the user.
   1.3 Techniques and criteria for evaluation of the proposed solutions.
   1.4 Organization of the process of selecting and purchasing IT system for the company.
2. Methods of implementation of information systems
   2.1 Review of methods of implementation of industrial information systems.
   2.2 Organization of implementation projects.
   2.3 Planning of implementation tasks.
   2.4 Risk analysis and assessment of the implementation.
   2.5 Realization of implementation tasks.
   2.6 Economic analysis of the effects of implementation.
   2.7 Corporate methodology of implementation projects.
   2.8 Audit of the implementation projects.
3. Integration and interoperability of industrial information systems
   3.1 The concept of integration and migration.
   3.2 Methods and techniques of integration of existing systems.
   3.3 Enterprise and exterior architecture. Interoperability of IIS.
4. The issue of operating systems
   4.1 Models exploitation of systems.
   4.2 Organization of the exploitation of information systems in enterprises
   4.3 Work instructions, safety, security access, system administration.
   4.4 Maintaining the system in motion.
5. Problems of modernization of information systems
   5.1 Management of the modernization and reorganization of industrial information systems.
   5.2 Logistical problems, management of system’s versions.
6. Methodologies

6.1 ITIL V3: phase, processes and functions.
6.2 Support tools.
6.3 Other methodologies: CMM, Six Sigma and CobiT.

6. UNIVERSITY COMPONENT (MAJORS)
ELECTRONICS, SENSORS AND ACTUATORS
Learning Units:

1. Introduction to Electronics
   1.1 DC (Direct Current) and AC (Alternating Current)
   1.2 Non-Linear circuits
   1.3 Diodes (simple equivalent circuit, with Vd=0,6, and Rd=0) (use in AC->DC rectifiers)
   1.4 Transistors (ideal model working as switch, may leave out BJT, FET, IGBT). Triac (ideal model working as switch) relays
   1.5 Operational Amplifier (simple equivalent circuit, with infinite gain and input impedance)
   1.6 Digital signals
   1.7 A/D and D/A conversion
2. Metrology. Notion of precision, resolution, repeatability, error.
3. Industrial sensors
   3.1 Proximity sensors (inductive, capacitive, ultra-sound, ...)
   3.2 End-effect sensors
   3.3 Rotational sensors (encoders)
   3.4 Other sensors (thermo-couples, pressure, ...)
   3.5 Electrical interfaces of sensors
   3.6 Automatic identification technology (barcodes, RFID, vision, …)
4. Industrial Actuators

4.1 Electric machines
4.2 Principles of operation
4.3 Synchronous motors
4.4 Asynchronous (induction) motors
4.5 Variable speed drives
4.6 Servo motors and drives
4.7 Pneumatic actuators
4.8 Single and double effect cylinders

4.9 Pneumatic valves (mono and bistable, 2-way, 3way, 4way, ...)
4.10 Pneumatic accessories (filters, pressure and flow regulators, ...)

BUSINESS 1
Learning Units:
The company and its environment
1.1 Introduction to the company
1.2. The economic environment of the company
1.3 The subsystems of the company
1. Management subsystem
2.1 General management concepts
2.2 Planning and control
2.3 Organization
2.4 Management
2. Marketing subsystem
3.1 Fundamentals of Marketing
3.2 Marketing-mix variables
3. Operations Subsystem
4.1The production of goods and services
4.2. Key strategic decisions

IIS PROJECT MANAGEMENT
Learning Units:
1. Creation of a system management model by projects. The professional organizations.
2. System representation of project management. System model.
3. Management objects. Project definition and programs.
4. Classification and singularities of projects.
5. A project Surrounding. An exterior surrounding of the project. An internal surrounding of the project.
6. Subjects of management. Project participants. A project command. Project organizational structures.
7. Management of project data domain. The concept. Planning.
8. Tasks of the big dimensionality. Procedure of a partition of Rozena.
9. The Organization and management by project data domain. The state and regulation analysis.
10. Project management on temporal parameters. The concept. Planning, management, the analysis and regulation.

11. Management in cost and the project finance. The concept, planning, the organization and management, the analysis and regulation.
12. Quality management in the project. The concept, planning, the organization and management, the analysis of a state and support.
13. Project management Functional areas. Risk management in the project.
14. Human resource management in the project.
15. Management of communications in the project.
16. Management of deliveries and contracts in the project.

7. INDIVIDUAL EDUCATIONAL TRAJECTORIES (DEVELOPMENT IIS)

OBJECT ORIENTED PROGRAMMING

Learning Units:

1. Terminology and basic principles of object-oriented programming (OOP). Evolution and Prospects of programming languages. Means increase the efficiency of software development at the expense of the PLO implementation.
2. Environment Interface Borland C ++. The concept and purpose of the form. Creating and linking forms. Components and input-output function.
3. Events and event handling.
4. Project files. The project structure. The structure of the module.
5. Routines in C ++. The main ways to pass parameters to the routine, their comparison. Area of visibility. Local and global identifiers.
6. Exception Handling. The concept and purpose of interfaces.
7. Application Connecting to a database. BDE and Components
8. ADO to view, edit, and delete database records. Create queries using SQL programming environment.
9. Setting the drawing parameters in C ++. Create graphic primitives using C ++ methods. Output of finished artwork in the application window C ++. Creating animation in C ++. Reference point method. Using components nents multimedia.
10. Create a plug-in C ++. The concept and implementation of dynamic link libraries (DLL).
11. Data abstraction in OOP. The need for and implementation of abstractions in OOP.
12. Encapsulation methods in OOP. Examples of encapsulate the implementation and application in the PLO.
13. Class Inheritance in OOP. Examples of the implementation and application of inheritance in OOP.
14. Polymorphism OOP methods of classes. Examples of implementation and application polymorphism.
15. The structure of the class description. Classes, objects and modules. The scope of classroom and field namespace names. Rules permit visibility
16. Types virtualneh methods. Methods of description and virtual function calls.
17. Overloading methods. Class methods and pointers to classes
18. The life cycle of an instance of the class. Static and dynamic an instance of classes. Declare and initialize an instance of the class. Types of designers. The destruction of the object. Destructors.
19. Compatibility objects. The definition of 'class and bringing types (casting) objects

IIS SOFTWARE ENGINEERING

Learning Units:

1. Introduction - Socio-technical Systems
   1.1 Emergent System properties. System s engineering. Organizations, people and computer systems. Legacy systems
   1.2 Software Processes. Process models, iteration and activities
   1.3 Rational Unified Process. CASE -Project Management- activities – planning. Scheduling – risk management.
2. Software Requirements
   2.1 Functional. Nonfunctional. User. System. Interface requirements
   2.2 Software requirements document. RE Processes. Feasibility studies. Elicitation. Analysis. Validation. Management of requirements
   2.3 Systems Models. Context. Behaviour. Data. Object models. Structured methods
   2.4 Architectural Design. Decisions. Systemorganization. Styles. Reference architecture.
3. Distributed Systems Architecture
   3.1 Multi processor. Client Server. Distributed Object
   3.2 Inter-Organizational Distributed Computing
   3.3 Application Architectures. Data. Transaction. Event. Language processing systems
   3.4 Object-oriented Design. Objects and object classes. An Object-oriented design Process.
   3.5 Design Evolution. User Interface Issues. The UI Design Process
   3.6 User Analysis. User Interface Prototyping. Interface Evaluation.
4. Agile Methods
   4.1 Extreme Programming. Rapid Application development
   4.2 Software Prototyping. Software Reuse
   4.3 The Reuse Landscape. Design Patterns
   4.4 Generator-Based Reuse
   4.5 Application Frameworks. Application SystemReuse. Software Evolution
   4.6 Program Evolution Dynamics. Software Maintenance. Evolution Processes. Legacy system evolution
   4.7 Planning Verification and Validation. Software Inspections. Automated Static analysis
   4.8 Verification and Formal methods. SoftwareTesting. System Testing. Component Testing. Test case Design. Test automation.
5. Software Cost Estimation
   5.1 Productivity. Estimation Techniques. Algorithmic Cost Modeling. Project Duration and Staffing. Process and Product Quality
   5.2 QualityAssurance and Standards. Planning. Control
   5.3 Software Measurement and Metrics. Process Improvement. Process Classification. Measurement
   5.4 Analysis and Modeling. Change. The CMMI process improvement Framework
   5.5 Configuration Management. Planning. Change Management.
   5.6 Version and Release Management. System Building. CASE tools for configuration management.

REAL-TIME SYSTEMS

Learning Units:

1. Introduction to Real-Time Embedded Systems
    - 1.1 Real-time scheduling
    - 1.2 The recurrent task model and constraints
    - 1.3 Periodic task scheduling (fixed priority, calculating WCRT, ...)
    - 1.4 Accessing shared resources (priority inversion, priority inheritance, ...)
    - 1.5 Aperiodic task scheduling (sporadic servers, ...)
2. Real-time operating systems
    - 2.1 OS/RTOS basics
    - 2.2 Approaches
    - 2.3 Inter process communication
    - 2.4 Concurrency
    - 2.5 Memory management
    - 2.6 RT POSIX extensions. Example of POSIX RT-OS (QNX, ...). Example of Real-Time executives for embedded systems (ecos, ...)
    - 2.7 Implementation in embedded system (cyclic executive, non-preemptive and preemptive fixed priority)
3. Overview of Formal Specification and Modeling

ARTIFICIAL INTELLIGENCE

Learning Units:

1. The subject of the study of artificial intelligence (AI). Historical review of the work in the field of AI.
2. Models of representations of knowledge for AI. Predicate calculus. System products. Semantic networks. Fuzzy logic.
3. Methods of finding solutions in the space. Heuristic search algorithms. Steepest descent algorithm for decision tree. The algorithm estimates (penalty) functions. Minimax algorithm.
4. Alpha-beta procedure. Methods of finding solutions based on the predicate calculus. Tasks of planning a sequence of actions. Finding solutions in production systems.
5. General characteristics of the pattern recognition and their types. Fundamentals of the theory of analysis and pattern recognition. Recognition by the method of analogies. Recent recognition problem.
6. Problems of natural language understanding. The analysis of natural language texts. The semantic interpretation. Problem analysis. Speech Communication Systems.
7. Expert systems: definitions and classifications. Difficulties in the development of expert systems. Methodology of expert systems. Examples of expert systems.
8. Imperative and declarative programming languages. Areas of use of Prolog. Prologue - the language of elementary education programming. Advantages and disadvantages of Prolog. Logical foundations of Prolog.

9. Suggestions: facts and rules. The objectives of internal and external. The relations (predicates). Free and bound variables. The anonymous variable. Clipping. "Green" and "red" clipping. Semantic models of Prolog. Recursion.
10. Fundamentals of Prolog. The structure of the program Prolog. Compiler directives.
11. Lists. Recursive definition list. Operations on lists.
12. Sorting algorithms lists: bubble, choice, insert, merge, fast sorting.
13. Realization sets in Prolog. Set Operations: making a list of the set element belonging to the set union, intersection, difference, inclusion, addition.
14. Binary trees, binary directories and operations on them. Processing lines.
15. Description of the file domain. Standard Prolog predicates for working with files. Recording information in the file. Reading information from the file. Rewriting data from file to file.

ROBOTICS SYSTEMS

Learning Units:

1. Introduction to Robotics
   - 1.1 Historical review
   - 1.2 Definitions
   - 1.3 Structure of robots
   - 1.4 Applications
   - 1.5 Selection criteria
   - 1.6 Statistics
2. Kinematic Robot Model
   - 2.1 Position and orientation representation
   - 2.2 Direct kinematics
   - 2.3 Reverse kinematics
   - 2.4 Speed kinematics
3. Robot Programming
   - 3.1 Programming Fundamentals
   - 3.2 RAPID Language
4. Dynamic Robot Model
   - 4.1 Lagrange-Euler method
   - 4.2 Newton-Euler's method
5. Robot Control
   - 5.1 Generation of trajectories
   - 5.2 Control of a joint

5.3 Robot Arm Control

6. Sensors, motors and mechanical transmissions
   6.1 Electrical, optical, magnetic, force sensors
   6.2 Pneumatic, hydraulic and electric motors
   6.3 Mechanical Transmissions

7. INDIVIDUAL EDUCATIONAL TRAJECTORIES (SERVICE IIS)
BUSINESS PROCESS MANAGEMENT
Learning Units:

1. Introduction to business process management
   1.1 How value is delivered?
   1.2 Process-centric approach
   1.3 Process management key terms and concepts
   1.4 Introduction to course case study
2. Enterprise business model
   2.1 Mission
   2.2 Vision
   2.3 Strategy
   2.4 Process
   2.5 Key skills, roles and responsibilities
3. Business process hierarchy
   3.1 Value-chain
   3.2 Level 1
   3.3 Level 2
   3.4 Level 3 and lower
   3.5 Exercise: Decomposition of business process
4. Business process architecture
   4.1 Management processes
   4.2 Core processes
   4.3 Supporting processes
   4.4 Business process map
   4.5 Exercises related to identifying and categorizing processes, and creating process map
5. Business process components

5.1 Inputs
5.2 Outputs
5.3 Triggers
5.4 Tasks
5.5 Governance, Rules and Knowledge

DATABASE ADMINISTRATION

Learning Units:

1. The basic software technology solution for collective work full-featured set of business applications and integration data management solution
2. Introduction, Installation, SQL Server Management Studio
3. Core Database Administration
4. Managing SQL Server 2012 Security
5. Manipulating Schemas, Tables, Indexes, and Views
6. Indices, constraints and partitions
7. Replication
8. Implementing Replication
9. Back Up and Recovery in SQL Server 2012
10. Database Automation and Maintenance
11. Create TRIGGER.
12. Create a stored procedure
13. ADO.NET 2.0, typed objects DATASet and binding technology with data in .NET
14. Native XML Web Services in SQL
15. Basics of OLAP. An in-depth study of OLAP. Expansion of the database system with the help of data mining.

NETWORK ADMINISTRATION

Learning Units:

1 Networking Overview
- 1.1 History
- 1.2 Protocol Standards
- 1.3 Reference Model (OSI, TCP/IP)
- 1.4 Windows and Linux Networking Basics
- 1.5 Switching and Routing basics

2 Server Administration Basics [6Hrs.]

- 2.1 Server and Client Installation
- 2.2 Boot Process and Startup Services: Xinetd/Inetd
- 2.3 Managing accounts: users, groups and other privileges
- 2.4 File Systems and Quota Management
- 2.5 Job Scheduling with cron, crontab, anacron and system log analysis
- 2.6 Process controlling and management
- 2.7 Online Server upgrade/update process
- 2.8 Administering Database Server (MySQL)

3 Network Configuration Basics [4Hrs.]
- 3.1 IPv4 and IPv6 addressing
- 3.2 Network Interface Configuration
- 3.3 Diagnosing Network startup issues
- 3.4 Linux and Windows Firewall configuration
- 3.5 Network troubleshooting commands

4 Dynamic Host Configuration Protocol (DHCP) [4Hrs.]
- 4.1 DHCP Principle
- 4.2 DHCP Server Configuration
- 4.3 DHCP Options, Scope, Reservation and Relaying
- 4.4 DHCP Troubleshooting

5 Name Server and Configuration [6Hrs.]
- 5.1 DNS principles and Operations
- 5.2 Basic Name Server and Client Configuration
- 5.3 Caching Only name server
- 5.4 Primary and Slave Name Server
- 5.5 DNS Zone Transfers
- 5.6 DNS Dynamic Updates
- 5.7 DNS Delegation
- 5.8 DNS Server Security
- 5.9 Troubleshooting

6 Web and Proxy Server Configuration [6Hrs.]
- 6.1 HTTP Server Configuration Basics
- 6.2 Virtual Hosting
- 6.3 HTTP Caching

6.4 Proxy Caching Server Configuration
6.5 Proxy ACL
6.6 Proxy-Authentication Mechanisms
6.7 Troubleshooting

7 FTP, File and Print Server [5Hrs.]
7.1 General Samba Configuration
7.2 SAMBA SWAT
7.3 NFS and NFS Client Configuration
7.4 CUPS configuration basics
7.5 FTP Principles
7.6 Anonymous FTP Server
7.7 Troubleshooting

8 Mail Server basics [6Hrs.]
8.1 SMTP, POP and IMAP principles
8.2 SMTP Relaying Principles
8.3 Mail Domain Administration
8.4 Basic Mail Server Configuration (Sendmail, postfix, qmail, exim..)
8.5 SPAM control and Filtering
8.6 Troubleshooting

9 Remote Administration and Management [4hrs.]
9.1 Router Configuration
9.2 Webmin/usermin
9.3 Team Viewer
9.4 Telnet
9.5 SSH
9.6 SCP, Rsync

STANDARDS OF IIS SERVICES

Learning Units:

1. Planning and Implementing Service Management
2. Planning and implementing new or changed services
3. Processes Service
4. Service Level Management

5. Formation of and reporting on services
6. Service Continuity Management and Availability
7. Budgeting and accounting for the cost of IT services
8. Capacity Management
9. Information Security Management
10. Group relations processes
11. Overview
12. Business Relationship Management
13. Contractor Management
14. Incident management
15. Problem Management
16. Configuration management
17. Change management
18. Release management ...

CLOUD TECHNOLOGY

Learning Units:

1: Basic Concepts
- 1.1 Introduction to cloud computing concepts
- 1.2 Components and characteristics of cloud computing model
- 1.3 Types of Cloud model(Public, Private, Hybrid, and community cloud)
- 1.4 Understanding of key Characteristics and deployment models (IaaS, PaaS, SaaS)
- 1.5 Key drivers and business benefits of cloud computing solutions
- 1.6 Minimizing the need for on premise hardware and software
- 1.7 Reducing the cost of ownership and maintenance(Upgrades etc)

2: Data Canter computing architecture
- 2.1 Understanding of various technology architecture in Cloud deployment
- 2.2 Grid computing architecture
- 2.3 Scale out Cluster computing architecture
- 2.4 Building and assessment of robust scale out cloud deployment for OLTP and Big Data processing workloads

3: Virtualization
- 3.1 Virtualization concepts and deployment in Cloud based Data canter
- 3.2 Hardware and OS virtualization

3.3 Hypervisor and Bare metal deployment
3.4 Virtual Box for portability and VM instance image
3.5 Maximum utilization of resources and monetization

4: Deployment of Services in Cloud

4.1 Deploying Infrastructure as a Service (IaaS), Elastic Compute and storage
4.2 Deploying Platform as a Service (PaaS), Dev/Test/Deploy
4.3 Deploying Software as a Service (SaaS), CRM, HCM etc.
4.4 Security, availability and disaster recovery strategies
4.5 Migrating to the Cloud, portability to on premise and cloud.

8.INTERDISCIPLINARY DISCIPLINES

INNOVATIVE ENTREPRENEURSHIP (BY INDUSTRY)

Learning Units:

1. The general provisions of the innovative entrepreneurship.
2. Introduction to the theory of innovations.
3. Innovation process and its stages.
4. The basic agents of innovative activity.
5. Preparation of an innovative project.
6. Business planning of innovation project.
7. Marketing of Innovation.
8. Managing Innovation in small business.
9. Financing innovation.
10. Examination of innovative projects.
11. The risks of innovation entrepreneurship.
12. Business ethics and corporate culture.
13. State innovation policy.
14. Legal aspects of innovation.

INTELLECTUAL RIGHTS

Learning Units:

1. The Introduction to Intellectual Law.
2. International regulation of Intellectual.
3. Activity Licensing Agreements.

4. The general concept of copyright.
5. Subjects and objects of copyright.
6. Copyright protect.
7. Allied rights.
8. The general concept of Patent Law.
9. Subjects and objects of Patent Law.
10. Patent, types, protection Topologies of Integrated Circuits.
11. Selection achievements.
12. Trade marks.
13. Commercial names.
14. The Right to Protect Confidential Information.
15. Illegal Use.

ECONOMETRICS

Learning Units:

1. Introduction to Econometrics.
2. Statistical hypothesis testing.
3. The statistical properties of estimators.
4. Model Estimation using Ordinary Least squares.
5. Multiple Linear Regression Model.
6. The Gauss-Markov Theorem.
7. Standard error of the regression.
8. Testing, hypotheses relating to the regression coefficients.
9. Coefficient of determination. The Chow test.
10. Specification of regression variables. Correlation.
11. Nonlinear econometric models.
12. Multicollinearity.
13. Heteroscedasticity.
14. Autocorrelation.
15. Detection of Autocorrelation.

ACCOUNTING AND AUDIT

Learning Units:

1. Fundamentals of Accounting

1.1. Accounting as an information system.
1.2. The concepts and principles of accounting.
1.3. The elements of financial statements and accounting items.
1.4. Balance sheet.
1.5. Accounting records and double entry.
1.6. Accounting organization.
1.7. The accounting cycle and the preparation of financial statements.
1.8. Accounting for current assets.
1.9. Accounting for long-lived assets.
1.10. Accounting for the current and long-term liabilities.
1.11. Revenue and expenditure accounting.
1.12. Accounting for equity.
1.13. Presentation of Financial Statements.

2. Fundamentals of Auditing
2.1. Essence and the subject of the audit methods.
2.2. Auditing standards and professional ethics of auditors.
2.3. The sequence of audit and quality control.
2.4. Materiality in the audit and audit risk.
2.5. Audit report.
2.6. The financial statements and the sequence of its audit.

GEOINFORMATICS

Learning Units:

1. Introduction. Aims and objectives of informatization of geographical research. Location of Geoinformatics in the sciences. Relationships with cartography, remote sensing and landscape science.
2. Geoinformatics, the basic concepts and terminology: information retrieval systems, databases, systems, database management, cartographic databases, expert systems, and others.
3. Classification of GIS on territorial coverage, on the objectives, topics. History of GIS development. The main features of the development of geoinformatics.
4. The structure of the GIS and its purpose. GIS functionality.
5. Information technology in geographic studies. Geographical GIS principles of the organization.

6. The formalization of geographic information. Method regular networks. Raster method. Vector method. Development of classifications and coding of thematic data. Standardization legend cards and encoding it.
7. Organization of geographic data banks and automated mapping. The logical and physical data organization. Database management system.
8. Mathematical-cartographic modeling of a series of maps and atlases as geosystems model. Methods of mathematical analysis, mathematical statistics, information theory. The principles of cartographic models popping.
9. Intellectualization of GIS. Creating expert systems. The concept of the knowledge base, the machine output, the system of accumulation of knowledge, the system of explanations and of communicating with the user.
10. Data analysis and modeling. GIS modeling unit. Conclusion and data visualization. Technical means of computer graphics. Features of creation of computer maps and atlases. Imaging spatiotemporal characteristics of systems using complex computer maps, pictures, slide films, motion pictures.
11. Examples of GIS implementation. Global Projects. International programs. National programs. Regional programs. Regional GIS. Local GIS. Creation of specialized GIS in geology, soil science, meteorology, hydrology.
12. The use of GIS in landscape. Prospects of GIS landscape local level.
13. Operation with three-dimensional objects. Surface modification. The visualization of three-dimensional objects in the visible region of the spectrum.
14. Topographic analysis. Generate profiles.
15. Current trends and problems of development of GIS. Prospects for the development of geoinformatics.

LATIN

Learning Units:

1. History of the Latin language and its role in shaping the international terminology.
2. Phonetics. Pronunciation of consonants, vowels and letter combinations.
3. Rules setting accents.
4. Nomen sustantivum. Grammatical categories of Latin nouns.
5. Nomen adjectivum. Declinatio 1, 2
6. Nomen adjectivum. Declinatio 3. The dictionary form of nouns of the 3rd declension. Determination of the basis.
7. Nomen adjectivum. Location and function of an adjective in a sentence. Degrees of comparison of adjectives. Consistent and inconsistent definition.
8. Nomen adjectivum. Gradus comparatives et superlativus.
9. Pronomena. Pronouns (personal and reflexive, possessive and demonstrative).
10. Nomena numeralia. Numerals (quantitative, ordinal, separation, adverbial). Declination and use numerals.
11. Verbum. Grammatical categories of Latin verbs.
12. Infekta system. Paradigms conjugation.

13. The syntax of a simple sentence. Driving parsing of a simple sentence.
14. Word formation. Basic Latin and Greek prefixes and suffixes of adjectives and nouns.
15. General questions of terminology.

CULTURE OF SPEECH AND LANGUAGE COMMUNICATION

Learning Units:

1. Language as a means of communication. Text as highest communicative unit. Structural and semantic analysis of text in specialty.
   1.1. Language and speech. Functional speech styles. Scientific style of speech. Language features of scientific style.
   1.2. It offers a minimum communicative unit. Logical-semantic relations in sentence. The proposed model. The formulation of question to semantic center of proposal and its basic properties.
   1.3. Text as highest communicative unit (text attributes, connectivity). Functional-semantic types of speech: description, narration, reasoning. The types of links in text.
   1.4. Structural and semantic articulation of text. Subject text. Communicative task of text.
   1.5. Methods of information in text.
   1.6. The progression of text. This new information and text.
2. Compression of text. Secondary scientific text.
   2.1. Compression of text. Methods and compression mold. The main and additional text information.
   2.2. Text Plan specialty. Types plan. Synopsis text.
   2.3. Abstract and abstract as the main genres of scientific speech in educational and professional spheres. Patent description as a basis for creation of a secondary text of any genre: modes of administration of initial information to the secondary text. Language means of the introduction of the initial information to the secondary text.
   2.4. Annotation. Annotations structure. Standard language means design annotations.
   2.5. Abstract. Types of abstracts.
   2.6. Standard design means abstract.

AL-FARABI AND CONTEMPORANEITY

Learning Units:

1. Al-Farabi's life and work.
2. Study of consciousness. Al-Farabi's concept of human cognitive ability.
3. Al-Farabi's theory of emanation and the role of mind.
4. Impact of Aristotelian and Stoic logic on formation of Al-Farabian logic.

5. Al-Farabi and the European Renaissance
6. The Primary Reason problem in the Al-Farabi's ontology
7. Interaction between "necessarily existing" and "potentially existing" in the Al-Farabi's ontology
8. Naturphilosophy and contemporaneity.
9. The place of natural science among classification of sciences by Al-Farabi
10. Interaction between natural science and study of God in the Al-Farabi's doctrine
11. Philosophy of art. The main ideas in Al-Farabi's "Great Book on Music"
12. The canons and genres defined by Al-Farabi in poetics.
13. Al-Farabi's outlook on religion.
14. Content of Al-Farabi's "On Religion" treatise
15. Al-Farabi's social-ethic teaching.
16. Al-Farabi on the role of religion in social needs.
17. City as the most perfect form of society.
18. The role of virtue in achievement of happiness.
19. "Al-Farabi university smart city" is a sample of Al-Farabi's virtues city. The role of cities in social development Essence and activity of contemporary smart-city.

CATALOG OF DISCIPLINS

EDUCATIONAL PROGRAM IN ENGLISH "INDUSTRIAL INFORMATION SYSTEMS"

5B070300 – INFORMATION SYSTEMS

	Discipline Name, Credits, Prerequisites	Purpose, tasks, course summary	Competences (results of training)
1. GENERAL EDUCATION			
GE	The modern history of Kazakhstan Prerequisites: no	Course objective. The purpose of the course is to give students objective historical knowledge about the main stages of modern history Kazakhstan; direct students' attention to the problems of formation and development of independent statehood in Kazakhstan, spiritual culture, continuity of ethnogenesis; bring home to students the essence of the fundamental problems of history, teach them scientific methods of historical knowledge, they form a scientific world outlook and civic position. The study of Modern History of Kazakhstan has a distinctive role in the education curriculum as it challenges students to consider the great social, technological, economic, political and moral transformations from the late eighteenth century to the present. It requires students to analyses the causes, progress and effects of these transformations and, finally, to make judgments about them. Modern History of Kazakhstan is especially relevant to the lives of students, as the events and issues that form its content are, in many cases, still current. The study of «Modern History of Kazakhstan» also contributes to the development of skills that are of great importance in today's workforce. The fluent communication of thoughts and ideas gleaned from the critical analysis of primary and secondary sources is a sought after skill. The ability to deconstruct texts and narratives, pose intelligent questions, test hypotheses and make critical use of information technologies is essential to living and working in the twenty-first century.	Knowledge: • the modern history of the Republic of Kazakhstan; • leading trends, key facts, events and processes in Kazakhstan throughout its history; • higher value-ideological norms and attitudes of selected experiences of historical development, ownership of cultural tradition, society, its people. Skill: • in modern conditions to implement the study of the history of the state and of law, based on research experience and knowledge in order to recreate an objective picture of the history of the state and the law of the country; • identify and retrieve information from different sources; • preparation of speeches, scientific articles and reports, reports and essays, writing term papers on key issues of national history.

GE	Kazakh (Russian) Language Prerequisites: no	Course objective. The goal of the course is to develop students' skills in reading, speaking, listening, writing in a Kazakh (Russian) language as part of the university program. Tasks: • expansion of lexical minimum of common words and phrases; • acquirement of lexical and terminological minimum in the specialty; • the construction of various types of speech activity: conversation, description, information; • reproduction and adapted to the production of simple pragmatic texts, dialogic and monologue, orally and in writing on topics relevant to the social and consumer and professional fields, according to various kinds of speech activity: speaking, listening, reading, writing.	Knowledge: • the specifics of the scientific style of speech; • thesis transformation plan (expansion, addition); • the formation and development of skills of drawing up denominative, of a question and thesis plans. Skill: • determine the type and volume of scientific information contained in the text; • analyze the structural and semantic organization of the text; • to make meaning-linguistic analysis of the text; • formulate a topic, identify system problems, allocate microtomes, to formulate the basic idea (paragraph text).
GE	Foreign Language Prerequisites: no	Course objective. The goal of the course is to develop students' skills in reading, speaking, listening, writing in a foreign language as part of the university program. As well as knowledge of the phonetic, spelling, vocabulary, grammar rules to learn foreign languages. Phonetics: the pronunciation and intonation, rhythmic characteristics of a foreign language, reception and reproduction of the sound of speech systems. Spelling: sound-letter language system, basic spelling rules. Vocabulary: word-formation models; lexical minimum volume of 2,500 units of the base language and the terms corresponding to the profile of the specialty.	Knowledge: • phonetics: the basic rules of reading and pronouncing the letters, the alphabet and letter combinations in the speech flow; • spelling: writing letters and letter combinations that match certain sounds, spelling corresponds to the frequency of lexical and grammatical features of the core language; • vocabulary: word-formation models, contextual values ambiguous words, terms and lexical sublanguage design, corresponding to the profile of the studied specialty; • grammar: the most frequent specific grammatical phenomena basic and natural human and technical sublanguages. Skill: • reading: read short texts with a dictionary and without a dictionary, to find the specified information to understand the content of reading;

			• writing: write a personal letter to a friend via email, dictation, fill in the form, the description of a friend, write a postcard • translation: translate text from a foreign language at home with the use of a dictionary in accordance with the rules of the target language; • listening: understand summary record and statements of a foreign language within the studied subjects; • speaking: express their thoughts and to speak in a foreign language, respectively, speech language standards, ask questions and answer them, hold a conversation in a foreign language in the volume of the studied subjects, consuming adequate communication cues to convey the contents read, heard.
GE	Philosophy Prerequisites: The modern history of Kazakhstan	Course objective. The goal of the course is mastering the philosophical legacy, gaining acquaintance with the main theoretical issues of philosophy, having students worked out a philosophical way of thinking and comprehending as well as the skill to think logically and creatively and to defend their own position logically convincingly. Tasks: • the study of the cognitive function of philosophy in the context of the development of world science; • consideration of the main trends shaping the philosophical and scientific rationality; • an analysis in the light of the philosophy of modern interpretations of the unity of the world, the relationship of its structural levels and spheres of existence and development; • the development of conceptual thinking culture, scientific approach to the problems of his specialty.	Knowledge: • studying philosophy can help students to enhance their problem-solving capacities, ability to organize ideas and issues, and ability to distinguish what is essential from what is not; • to become better able to look at things from a variety of perspectives, to understand different viewpoints, and to discover common ground among them; • to learn how to critically examine their own views as well as those of others; • to develop the ability to understand and explain difficult material; • to learn how to distinguish good reasoning from attempts to manipulate opinions, to construct sound complex arguments, and to evaluate others' reasoning; • to develop good interpretive, comparative, argumentative, analytical, and descriptive speaking and writing skills that will allow them to communicate their ideas in a clear and powerful way.

			Skill: • work with philosophical texts, to use them to study the actual problems of human society and nature; • analyze the fundamental issues of the origin and evolution of the scientific picture of the world; • to focus in the conceptual apparatus and terminology of scientific knowledge of philosophy; • to develop and defend their own scientific positions; • to decide the theoretical and methodological issues in the branch of science.
GE	ICT Technologies Prerequisites: no	Course objective. Discipline aims to familiarize students with the theoretical and practical information, which reflect the main trends in the development of computer science, maintenance and acquisition of knowledge and skills of the students in the use of modern software in the subject field, the development of efficient algorithms for solving scientific and engineering problems of mathematical and numerical modeling using modern programming languages to learn the basics of computer graphics, database design, the basic concepts of networking. This course aims to improve the skills of students on the use of information technology. The course is supported by the advanced practicum. The objective of the discipline is to acquire theoretical knowledge about information processes, on new information technologies, local and global computer networks, methods of information protection. During the program, students must learn and rational use of the opportunities offered by computer technology to solve life's problems, get skills to use word processing, spreadsheet, database, different categories of applications.	Knowledge: • to define the main tendencies in the field of information communication technologies; • to know what economic and political factors promoted development of information communication technologies; • to know architecture, to be able to calculate and evaluate performance measures of supercomputers; • to know features of different operating systems. Skill: • to use information resources for search and information storage; • to work with electronic spreadsheets, to execute consolidation of data, to build diagrams; • to work with databases; • to apply methods and means of information protection; • to project and create simple web sites; • to make processing of vector and bitmap images; • to create the multimedia presentations; • to use different social platforms for communication; • to use different forms of e-learning for extension of professional knowledge; • to use different cloud services.
2.BASIC DISCIPLINES			

BD	Professionally-Oriented Kazakh (Russian)Language Prerequisites: Kazakh (Russian) Language	Course objective. Mastering the principles of technical writing, getting skills of construction theoretical calculations, familiarity with the scientific and technical documentation in the subject area of specialty, and the study the theory, methods and computer simulation technology in the study and design of industrial information systems and processes.	Knowledge: modern vocabulary and terminology in Kazakh (Russian) Language for technology and project management methodology, project management processes, modern software project management. Skill: apply organizational project management tools to determine the hierarchical structure of the project works, use of formal methods of evaluating the time and resources of the project objectives, determine the amount and sources of funding, to plan and to consider the risks.
BD	Professionally-Oriented Foreign Language Prerequisites: Foreign Language	Course objective. Learning of special terminology, vocabulary in a foreign language, the theoretical foundations of project management methodology, project management process groups, drafting documents of the project, the project management directly using the modern tools of the software.	Knowledge: modern vocabulary and terminology in English for technology and project management methodology, project management processes, modern software project management. Skill: apply organizational project management tools to determine the hierarchical structure of the project works, use of formal methods of evaluating the time and resources of the project objectives, determine the amount and sources of funding, to plan and to consider the risks.
BD	Physics Prerequisites: no	Course objective. Formation of students understanding of modern physical picture of the world and the scientific worldview, the basic physical phenomena; mastery of fundamental concepts, laws and theories of classical and modern physics, as well as methods of physical research; mastery of techniques and methods of solving specific problems in various fields of physics; introduction of modern scientific equipment, the skills of the behavior of physical experiment, the ability to highlight specific physical content in applications future activities.	Knowledge: • essence of the basic concepts, laws and theories of classical and modern physics in their internal relationships and integrity; • hierarchy of physical laws and concepts, the boundaries of their applicability, allowing to use them effectively in specific situations. Skill: • generalized solutions of typical problems (theoretical and experimental and practical learning tasks) from different

			areas of physics as the basis of decision of professional problems; • assess the degree of reliability of the results of experimental and theoretical research methods; • to simulate the physical situation of the computer; • carrying out experimental research and processing of results, the ability to allocate physical content in applications of the future specialty.
BD	Mathematic I Prerequisites: no	Course objective. The study of the theory of real numbers; exact upper and lower bounds set of numbers; limits numerical sequence; convergence criteria, the basic properties of convergent sequences. Number series, convergence criteria. Functions of one and several variables, continuity and differentiability of functions, extremes of functions, theory of functional series. Riemann integral, properties of the integral, on the mean value theorem. Numerical methods of differentiation and integration. Applications of differential and integral calculus.	Knowledge: confident knowledge of the structure of the space of real numbers, convergence of numerical sequences, understanding of the convergence criteria. Mastering the basics of methods of researches of the properties of the functions, a clear understanding of the concepts of continuity of functions, their differentiability, integrability. Skill: the ability to apply in practice, numerical methods differentiability and integrability. To know the specific conditions of the convergence of numerical methods. Get the practical skills to apply differential and integral calculus in problems of mechanics and physics.
BD	Mathematic II Prerequisites: Mathematic I	Course objective. The study of differential equations in one and several variables, applied problems of mechanics and physics, variational principles of mechanics, the equations of mathematical physics. Numerical methods for solving equations, the concept of convergence of the solution methods uchloviya convergence of difference equations. Applications of differential equations.	Knowledge: fluency in knowledge of applied problems of differential equations, the acquisition of skills in the use of differential equations for modeling of mechanical and physical systems. Skill: possession of the basic methods of numerical solution of differential equations, the acquisition of programming skills of numerical methods to basic procedural languages.
BD	Mathematic III Prerequisites: Mathematic II	Course objective. Learning the basics of probability theory, random sequences, types of convergence. Mastering the knowledge of the theory of large numbers, limit theorems. The study of Markov chains and processes, ergodic theory. The study of statistical estimates, their representativeness, bias and reliability. Mastering the basics of regression analysis, point	Knowledge: fluency in the basics of probability theory, the law of large numbers, limit theorems, convergence conditions for different types of knowledge on sustainable and divisible distributions. Getting strong application skills to various problems of physics, biology, natural science.

		estimates, confidence interval methods, hypothesis testing theory. Mastering the basics of correlation analysis of random processes theory. Numerical Methods of Statistics, Monte-Carlo method.	Skill: good knowledge and use of knowledge on the theory of stochastic processes, numerical methods for solving statistical methods. The ability to use the theory of interval estimates, hypothesis testing theory to applied problems. Skillful use of regression analysis. To be able to use the correlation analysis of random processes.
BD	Algorithms, data structures and programming Prerequisites: no	Course objective. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, binary search trees and graphs; implement algorithms for constructing a finite state machine for linear grammar, and conversely, a pushdown automaton for a context-free grammar; work with the functions of time and space complexity of algorithms for evaluation. the syntax and semantics of programming languages, basic models, approaches and programming techniques; Basic programming language constructs to write algorithms, data types and structures; technology design and development programs.	Knowledge: the fundamental principles of algorithm design: divide and conquer techniques, graph algorithms, data structures (heap, hash tables, search trees); modern technologies of constructing algorithms based on structures of the used data and the computer systems for which they are implemented. Programming paradigms, syntax and semantics of programming languages, basic models, approaches and programming techniques; Basic programming language constructs to write algorithms, data types and structures; software design and development of technologies; software architecture; Skill to construct efficient algorithms and implement them in programming languages; to carry out the lexical analysis, parsing, effective implementation of the software.
BD	IT infrastructure Prerequisites: ICT Technologies	Course objective. This course provides an introduction to IT infrastructure issues for students majoring in Information Systems. It covers topics related to both computer and systems architecture and communication networks, with an overall focus on the services and capabilities that IT infrastructure solutions enable in an organizational context. It gives the students the knowledge and skills that they need for communicating effectively with professionals whose special focus is on hardware and systems software technology and for designing organizational processes and software solutions that require in-depth understanding of the IT infrastructure capabilities and limitations. It also prepares the students for	Students will learn to: • Understand the principles underlying layered systems architectures and their application to both computers and networks. • Understand the differences and similarities between the core elements of an IT infrastructure solution, such as clients, servers, network devices, wired and wireless network links, systems software, and specialized security devices. • Understand how IT infrastructure components are organized into infrastructure solutions in different organizational environments.

		organizational roles that require interaction with external vendors of IT infrastructure components and solutions.	• Understand through practical examples how protocols are used to enable communication between computing devices connected to each other. • Configure an IT infrastructure solution for a small organization, including a network based on standard technology components, servers, security devices, and several different types of computing clients. • Apply the core concepts underlying IP networks to solve simple network design problems, including IP subnetting. • Understand the role of IT control and service management frameworks in managing a large-scale organizational IT infrastructure solution. • Analyze and understand the security and business continuity implications of IT infrastructure design solutions.
3. MAJORS			
M	Fundamentals of information systems Prerequisites: ICT technologies	Course objective. Information systems are an integral part of all business activities and careers. This course is designed to introduce students to contemporary industrial information systems and demonstrate how these systems are used throughout global organizations. The focus of this course will be on the key components of industrial information systems - people, software, hardware, data, and communication technologies, and how these components can be integrated and managed to create competitive advantage. Through the knowledge of how IS provides a competitive advantage students will gain an understanding of how information is used in organizations and how IT enables improvement in quality, speed, and agility. This course also provides an introduction to systems and development concepts, technology acquisition, and various types of application software that have become	Knowledge: • how and why information systems are used today; • the technology, people, and organizational components of industrial information systems; • how businesses are using industrial information systems for competitive advantage vs. competitive necessity; the value of information systems investments as well as learn to formulate a business case for a new industrial information system, including estimation of both costs and benefits; • the major components of an industrial information systems infrastructure; • how various types of information systems provide the information needed to gain business intelligence to

		prevalent or are emerging in modern industrial organizations and society.	support the decision making for the different levels and functions of the organization. Skill: confidently own methods of statistical data analysis, methods of regression and correlation analysis, numerical methods of statistical data processing. To possess the basic techniques of the analysis of economic and technical information with modern technologies from Microsoft, Oracle and Intel.

M	Database in IS Prerequisites: Algorithms, Data structures and Programming	Course objective. This course provides the students with an introduction to the core concepts in data and information management. It is centered around the core skills of identifying organizational information requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational data models and verifying its structural characteristics with normalization techniques, and implementing and utilizing a relational database using an industrial-strength database management system. The course will also include coverage of basic database administration tasks and key concepts of data quality and data security. In addition to developing database applications, the course helps the students understand how large-scale packaged systems are highly dependent on the use of DBMSs. Building on the transactional database understanding, the course provides an introduction to data and information management technologies that provide decision support capabilities under the broad business intelligence umbrella.	Knowledge: • the role of databases and database management systems in managing organizational data and information; • the basics of how data is physically stored and accessed; design high-quality relational databases; • the purpose and principles of normalizing a relational database structure; • implement a relational database design using an industrial-strength database management system, including the principles of data type selection and indexing; the data definition, data manipulation, and data control language components of SQL in the context of one widely used implementation of the language; • the concept of database transaction and apply it appropriately to an application context; • the basic mechanisms for accessing relational databases from various types of application development environments; • the role of databases and database management systems in the context of industrial systems; • the key principles of data security and identify data security risk and violations in data management system design.
4. GENERAL EDUCATION University component (7 credits)			
GE	Programming Prerequisites: no	Course objective. Competence in programming. The ability to independently and in a team to develop software for business, for entertainment purposes. Ability to develop software for mobile devices. The development of complex	Knowledge of programming paradigms, syntax and semantics of programming languages, basic models, approaches and techniques of programming; basic structures of programming languages for writing algorithms, types,

		websites with elements of programming. Understanding of the development process, compile, and life cycle	and data structures; technology design and development; software architecture.
GE	Fundamentals of automation and control Prerequisites: Physics	Course objective. Cclassification of system elements automation. The basic principles of control and regulation. Model structure and means of APCS. The local system of control, regulation and control. Automated control system of technological processes. Typification, standardization and aggregation means of APCS. Signals unified automation devices. Functional diagram automation. Automatic controllers of automation systems. Electronic elements of automation systems. Programmable logic controllers. Electromagnetic devices of automation. Typical relay circuits. Transformers. Measuring transducers. Actuators and the device of systems of automation. Electrical machines DC.	Knowledge: principles of designing and functioning serial technical and program-technical automation, the structure and functional the software of automation systems. Skill: elect technical and program-technical means for creation of ACP and ACS, to execute design layout, technical and program-technical means of automation.
5. BASIC DISCIPLINES UNIVERSITY COMPONENT (49 credits)			
BD	Industrial computing Prerequisites: ICT technologies	Course objective. The subject aims to train the future engineer in the planning, design and development of industrial computer systems based on a personal computer. The student will learn the implementation of modular computer projects that incorporate user interface management techniques, process interface, database and task planning	Knowledge: • knowledge of the fundamentals and applications of digital electronics and microprocessors; • applied knowledge of industrial computing and communications; • ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering
BD	Microcontrollers Prerequisites: Physics	Course objective. Practical skills in the development of programs for the microcontroller and the PLC and debug them in the development of control devices based on microcontrollers and PLCs.	Knowledge: PLC LOGO! and LOGO! SOFT COMFORT Skill: Structure of the instrumental base on which to build monitoring and control of production processes. The contents of the state system of the instrument. Varieties and characteristics of primary and secondary equipment, automatic regulators, power systems devices. The use of

			microprocessors and computers to control systems and management. The basic stages and modern trends of development of technical means.
BD	Industrial Production Systems Prerequisites: ICT Technologies	Course objective. New IS technologies are being used to change how organizations operate, produce products and services, and communicate both internally and as well as with external partners. This course is designed to introduce students to new and innovative technologies and examine how these powerful systems have fundamentally reshaped modern organizations along with our society. Using online collaborative technologies that were developed New Technologies in the context of social networking and online communities, corporations are reengineering both internal business processes and those related to customers, suppliers, and business partners. Developing innovative ways to communicate and collaborate can lead to new business opportunities, and new efficiencies. This course investigates the technologies, methods and practices of developing new innovations such as online communities, and how this knowledge and these skills are applied to reengineer business processes. For example, how products, services and industrial information systems are developed, and how geographically disperse virtual teams collaborate.	Students will learn to: • Understand how technologies are increasing the ability of organizations to globalize business processes and to extend their reach to global customers. • Apply the techniques used to innovate IS technologies. • Understand how businesses have used IS technologies to innovate and reengineer business processes. • Understand the concepts associated with network effects. • Understand how the Web as a platform enhances creativity, information sharing and functionality. • Understand the role of Web technologies such as online communities in the business world, and how they deliver value. • Apply the popular community-oriented tools, such as online social networking tools, to business problems. • Apply basic tools of economics to digital goods and services. • Deal with the challenges associated with new technologies and innovation. • Basic knowledge of production and manufacturing systems. • Capacity for management of the activities covered by the engineering projects. • Ability to apply principles and methods of quality • Ability to apply knowledge about occupational health and safety, prevention of occupational hazards and safety in machines, according to the current legislation on passive and active protection on fires, and aspects of noise pollution

BD	Continuous and digital control Prerequisites: Fundemantels of Automation and Controls	Course objective. To give basic information about the digital devices used in automation equipment, to master methods of analysis and synthesis	Knowledge: A modern approach to the design of digital devices. Basic theory of digital circuits. Logic gates: types and main characteristics. Combinational circuits and their synthesis. Codes used in digital devices. Devices and their synthesis. The use of digital devices in automation Skill: to develop digital devices of automation
BD	Programming Web Applications IIS Prerequisites: Algorithms, Data structures and Programming	Course objective. This course provides the knowledge and skills to develop web applications. The course will help students understand how start with basic web development concepts, and how to use existing applications from the Application Gallery. The course will describe basic web development, including CSS, plug-ins, scripting, basic data access, and application hosting.	Knowledge: • Describe the components of web technologies that developers can use to host websites, host data, run code, and develop code. • Describe how a website is developed, including the planning, development, testing, iteration and release phases and how to use WebMatrix 2 in each phase. • Describe how to store data in a database and display it on a WebMatrix 2 site to create a dynamic web application. • Describe possible locations for hosting a production website and deploy a completed website to a chosen hosting provider. • Describe the common sources of website errors and use WebMatrix 2 tools and coding techniques to diagnose problems and correct code. • Ensure a website is secure against malicious attacks and identify users before granting them access to sensitive content. • Describe how client-side coding techniques accelerate responses to users and reduce network traffic for a website, and use common client-side coding techniques. • Describe the features of Visual Studio and ASP.NET Web Forms that enable developers to create more powerful web applications. Skill: • Create a website by using WebMatrix 2 and add dynamic webpages to enable user interaction. • Integrate information supplied from web services, data feeds, RESTful services, and other sources into a web application.

			• Browse the packages available in the NuGet tool, select a package that matches a functional requirement, add it to a web application, and write code that uses the features of the package. • Integrate images, audio files, video files, and other media into a web application for different browsers. • Apply a consistent visual style and user-friendly navigation hierarchy to a website. • Analyze the user traffic on a public website and optimize the site to appear close to the top of search engine results.
BD	Operations research and Methods of optimization Prerequisites: Mathematic I, II	Course objective. Learn the techniques of operations research, basic methods of graph theory, the specific formulation and methods for solving linear and mathematical programming, to learn methods for solving linear programming problems, study the optimality criteria in mathematical programming problems, study the duality theory and research methods of mathematical programming tasks based on them. To study numerical methods for solving mathematical programming problems.	Knowledge: confident knowledge of the basics of research operations, diversified methods of investigation and multiproduct mathematical models of the economy, based on mathematical modeling of problems of graph theory. Skill: successfully applied setting skills of optimization problems of the economy, logistics, inventory management theory, scheduling theory. To be able to use numerical methods for solving optimization problems, problems of modeling of economic, administrative processes, monitoring processes, customer service.
BD	Industrial simulation techniques Prerequisites: Mathematic III	Course objective. Learning the basics of computer simulation, the acquisition of knowledge and skills of students in the simulation of discrete, continuous system, problem solving, practical use of tools, allowing to implement, debug, and run in practice all kinds of models studied. Set out in the course of a set of knowledge and skills is a theoretical basis for computer simulation, modeling principles are discussed in detail, the use of modern technologies and systems modeling, analysis. The study course is supported by the advanced laboratory practicum.	Knowledge: • basic concepts and statements of simulation theory; • basic approaches and methods used in the simulations of telecommunication networks and systems; • modern means of simulation; • develop simulation models of processes in telecommunication networks and systems for solving research problems in this area; • put experimental studies using simulation models and to carry out statistical analysis of the results. Skill: • development of the large amount of information; • simulation models in GPSS programming environments, MATLAB;

			• setting skills of experimental research for the solution of scientific research tasks in the field of telecommunication networks and systems.
BD	Data mining Prerequisites: Database in IS, Fundamentals of information systems	Course objective. To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining. Students will be able to actively manage and participate in data mining projects executed by consultants or specialists in data mining. A useful take away from the course will be the ability to perform powerful data analysis in documents	Knowledge: • Learn the concept of database technology evolutionary path which has led it the need for data mining and its applications. • Examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system. • Apply preprocessing statistical methods for any given raw data. • Explore DWH and OLAP, and devise efficient and cost effective methods for maintaining DWHs. • Students able to select and apply proper data mining algorithms to build analytical applications.
BD	Business II Prerequisites: Business I	Course objective. The objective of this course is that the students know the operation of the company as an organization that relates to the environment. Thus, students must acquire the necessary knowledge to understand and analyze the financial relationships of companies in the markets in which they develop. Thus, the student must master both the concepts related to financial analysis and the accounting analysis of the company, as well as those related to its microeconomic and macroeconomic environment. Thus, the student must perform: Market Analysis. Study of programming techniques and financial planning, and their application. Treatment of business investments of an economic type: measurement of returns. Treatment of financial decisions: financing. Requirements for financial information: financial statements.	Knowledge: • Business organization applied knowledge. • Ability to organize and plan in the field of the company, and other institutions and organizations.

BD	Industrial System Analysis and Design Prerequisites: Business I, Business II	Course objective. This course discusses the processes, methods, techniques and tools that organizations use to determine how they should conduct their business, with a particular focus on how computer-based technologies can most effectively contribute to the way business is organized. The course covers a systematic methodology for analyzing a business problem or opportunity, determining what role, if any, computer-based technologies can play in addressing the business need, articulating business requirements for the technology solution, specifying alternative approaches to acquiring the technology capabilities needed to address the business requirements, and specifying the requirements for the industrial information systems solution in particular, in-house development, development from third-party providers, or purchased commercial-off-the-shelf (COTS) packages .	Students will learn to • Understand the types of business needs that can be addressed using information technology-based solutions. • Initiate, specify, and prioritize industrial information systems projects and to determine various aspects of feasibility of these projects. • Use at least one specific methodology for analyzing a business situation (a problem or opportunity), modeling it using a formal technique, and specifying requirements for a system that enables a productive change in a way the business is conducted. • Manage information systems projects using formal project management methods. • Articulate various systems acquisition alternatives, including the use of packaged systems (such as ERP, CRM, SCM, etc.) and outsourced design and development resources. • Use contemporary CASE tools for the use in process and data modeling. • Design high-level logical system characteristics (user interface design, design of data and information requirements).
BD	IIS audit and control Prerequisites: Fundamentals of information systems	Course objective. This course introduces the fundamental concepts of the information technology audit and control function. The main focus of this course is on understanding information controls, the types of controls and their impact on the organization, and how to manage and audit them. The concepts and techniques used in information technology audits will be presented. Students will learn the process of creating a control structure with goals and objectives, audit an information technology infrastructure against it, and establish a systematic remediation procedure for any inadequacies. The challenge of dealing with best practices, standards, and	Students will learn to: • Understand the role and objectives of information technology audits. • Develop an appropriate information technology audit process. • Identify risks to the confidentially, integrity, and availability of information and processes. • Describe the risks inherent in various types of information systems ranging from manual, basic accounting, to advanced operational information and knowledge for decision making.

		regulatory requirements governing information and controls is addressed.	• Understand how to design and implement assurance procedures and control measures to effectively manage risks. • Understand the role of auditing in systems development, including the review of the development process and participation in systems under development.
BD	Process Monitoring and Control Prerequisites: Fundamentals of information systems	Course objective. This course provides to students with a basic understanding of SCADA systems that all engineers need to learn when entering this field of engineering, including the background of SCADA, how and where they are used in today's industry as well as SCADA programming as undertaken when designing manufacturing data acquisition for any type of SCADA system. This course is primarily for students who have no knowledge or experience in SCADA programming and wish to pursue a career, working with SCADA systems, but also may be found interesting by anyone interested in SCADA systems and how they work. You will learn, basic SCADA terminology, the differences between HMI and SCADA, creating screens with the screen editor, screen layout convention, templates and navigation, running the simulator, creating dynamic content such as bar graphs, sliders, 3D effects, indicators, buttons and more.	Students will learn to • Design and develop the core system to collect, measure and analyze desired information catered to your organization's specific needs. • Minimize adverse impacts of power trips through effective protection grading & coordination. • Improve knowledge of power system design, planning, analysis, protective device applications & relay. • Schemes for safe and efficient operation of electrical power systems and equipment. • Identify valuable insights through actual cases illustrating modern techniques and highlighting particular approaches used by experienced system designers. • Align power system protection problems commonly faced by industry and adopt recommended solutions, which have been proven successful. • Apply microprocessor based multi-function relays on protection of various power system equipment and apparatus.
BD	IIS Strategy, Management, Acquisition and Ecology Prerequisites: Fundamentals of information systems	Course objective. This course explores the issues and approaches in managing the information systems function in organizations and how the IS function integrates/supports/enables various types of organizational capabilities. It takes a senior management perspective in exploring the acquisition, development and implementation of plans and policies to achieve efficient and effective information systems. The course addresses issues relating to defining the high-level IS infrastructure and the systems that support the	Students will learn to • Understand the various functions and activities within the information systems area, including the role of IT management and the CIO, structuring of IS management within an organization, and managing IS professionals within the firm. • Understand the concepts of information economics at the enterprise level.

		operational, administrative and strategic needs of the organization. The remainder of the course is focused on developing an intellectual framework that will allow leaders of organizations to critically assess existing IS infrastructures and emerging technologies as well as how these enabling technologies might affect organizational strategy. The ideas developed and cultivated in this course are intended to provide an enduring perspective that can help leaders make sense of an increasingly globalized and technology intensive business environment.	• Appreciate how IS represents a key source of competitive advantage for firms. • Understand existing and emerging information technologies, the functions of IS and its impact on the organizational operations. • Evaluate the issues and challenges associated with successfully and unsuccessfully incorporating IS into a firm. • Apply information to the needs of different industries and areas. • Understand the role of IT control and service management frameworks from the perspective of managing the IS function in an organization.
BD	Enterprise Architecture and ERP-system Prerequisites: Fundamentals of information systems	Course objective. This course explores the design, selection, implementation and management of enterprise IT solutions. The focus is on applications and infrastructure and their fit with the business. Students learn frameworks and strategies for infrastructure management, system administration, data/information architecture, content management, distributed computing, middleware, legacy system integration, system consolidation, and software selection, total cost of ownership calculation, IT investment analysis, and emerging technologies. These topics are addressed both within and beyond the organization, with attention paid to managing risk and security within audit and compliance standards. Students also hone their ability to communicate technology architecture strategies concisely to a general business audience. Explore the technology of designing the architecture of ERP-systems, enterprise information systems, templates, UML language design, flexible design techniques, and Share Point platform of Microsoft. Explore the well-known ERP-system Axapta, Navision and SAP R3. To study the basic methods of	Students will learn to • Understand a variety of frameworks for enterprise architecture analysis and decision making. • Evaluate the total cost of ownership and return on investment for architecture alternatives. • Utilize techniques for assessing and managing risk across the portfolio of the enterprise. • Evaluate and plan for the integration of emerging technologies. • Administer systems, including the use of virtualization and monitoring, power and cooling issues. • Manage proliferating types and volume of content. • Understand the core concepts of data/information architecture and evaluate existing data/information architecture designs. • Plan for business continuity. • Understand the benefits and risks of service oriented architecture. • Understand the role of audit and compliance in enterprise architecture.

		compliance with secure access to the elements of corporate networks and databases. To study the basic techniques to optimize corporate systems based on Microsoft Oracle technologies. Explore modern imaging techniques of enterprise information based on Microsoft Office, ASP.NET MVC. Master the techniques of programming mobile applications on modern operating systems Android, iOS and Windows Phone.	• Understand the integration of enterprise systems with interorganizational partners such as suppliers, government, etc. Knowledge: To know the basic techniques of designing the architecture of industrial systems based on programming techniques. Know the basic elements of the theory of industrial systems, templates, design and administration of industrial information systems based on Share Point technology. Know the basics of programming networking and remote access to the ERP-system. Skill: Confident Design technology possess knowledge of corporate systems, their patterns, be able to apply the skills of information systems software, remote access to the corporate system, the security of the theory of networks and servers eorporativnyh systems.
BD	Information security management in the IIS Prerequisites: Fundamentals of information systems	Course objective. In this study the main types of discipline, especially the functioning and scope of the information security management systems, provides a detailed overview and description of the most important methods and security models, as well as practical problems to be solved in the field of information security. For this audit systems are being implemented using a variety of systems and development environments. Performs innovative engineering projects to develop software for various purposes with the use of modern methods of design and implementation is carried protection systems and security management organization and production. In the process of training activities carried out software implementation of various algorithms, digital signature, and electronic payment systems in order to solve practical problems different. Objectives of the course: to master the methods of creation and management of Industrial Information Systems; learn basic models and methods of information protection; learn the basic methods of modeling and management of information security systems; master the	As a result of studying the course, students should: To be able to: design the information model specific system and method of protection, the use of modern programming languages, data processing, and use advanced features to protect networks and operating systems and their analysis. Competence: • In a practical design and building information security systems, building information applications using the latest protection algorithms and languages on different hardware platforms. • Analyze the system of information security organization and production. • Design and development of information security management system and the organization of production safety Learning outcomes: • The ability to build a system of information security management organization and production.

		use of these methods in practical problems, to introduce undergraduates to the current state of research in the field of building management systems, security management systems and their application to practical problems, provide a basis for self-selection and development of new models of management systems information security organization and production.	• The use of different data protection algorithms. • The use of different models and methods, and audit systems at information security management. • Justification for choice of specific information security management system. • Solving the problems of information security management organization and production.
BD	IIS deployment and maintenance Prerequisites: Fundamentals of information systems	Course objective. The purpose of this course is to introduce the students to the fundamental concepts and models of application development so that they can understand the key processes related to building functioning applications and appreciate the complexity of application development. Students will learn the basic concepts of program design, data structures, programming, problem solving, programming logic, and fundamental design techniques for event-driven programs. Program development will incorporate the program development life cycle: gathering requirements, designing a solution, implementing a solution in a programming language, and testing the completed application.	Students will learn to: • Use primitive data types and data structures offered by the development environment. • Choose an appropriate data structure for modeling a simple problem. • Understand basic programming concepts. • Write simple applications that relate to a specific domain. • Design, implement, test, and debug a program that uses each of the following fundamental programming constructs: basic computation, simple I/O, standard conditional and iterative structures, and the definition of functions. • Test applications with sample data. • Apply core program control structures.
6. MAJORS Elective Course (10 credits)			
M	Electronic, Sensors, Actuators and Metrology Prerequisites: Physics	Course objective. The development of electronics is characterized by the constant increase in complexity of electronic devices. Currently, it is considered that the complexity of electronic equipment every five years increases by about 10 times. Application devices in electronics, computing, automation, energy acquired a mass character due to their large advantages: high efficiency, durability, reliability, small dimensions, etc. Characteristic of the present stage of scientific and technological revolution is the application of increasingly complex but more reliable electronic equipment. So one of the main directions of	Knowledge: • the physical processes in them; • scope of semiconductor devices; • the principles of electrical circuits containing semiconductor devices. Sources of difficulty – implementation environment (vacuum, clean facilities, etc.) – perception that in-situ sensors affect process – ex-situ sensors can reduce throughput – cost of ownership – traditional resistance in industry.

		development of semiconductor electronics during the past decades has been the integrated microelectronics. Sensors (and actuators) are key limiting factors in application of control techniques to semiconductor manufacturing.	Skill: knows how to compose models of physical processes and to develop methods and algorithms to solve them; has mastered the principles of electrical circuits containing semiconductor devices.
M	Business I Prerequisites: no	Course objective. The objective of this subject is to situate the company in its environment (with special attention to the economic environment) from a systemic approach, serving as an introduction to three large business subsystems: management and control, commercial and operations. In addition, it pretends that the student acquires the sufficient knowledge that allows him to understand the process and basic functions of the management and direction of companies.	Knowledge: • adequate knowledge of the company concept, institutional and legal framework of the company; • organization and management of companies; • ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering; • ability to apply principles and methods of quality; • ability to work in a multilingual and multidisciplinary environment.
M	IIS Project Management Prerequisites: Fundamentals of information systems	Course objective. This course discusses the processes, methods, techniques and tools that organizations use to manage their information systems projects. The course covers a systematic methodology for initiating, planning, executing, controlling, and closing projects. This course assumes that project management in the modern organization is a complex team-based activity, where various types of technologies (including project management software as well as software to support group collaboration) are an inherent part of the project management process. This course also acknowledges that project management involves both the use of resources from within the firm, as well as contracted from outside the organization.	Students will learn to • Understand the foundations of project management, including its definition, scope, and the need for project management in the modern organization. • Understand the phases of the project management lifecycle. • Manage project teams, including the fundamentals of leadership and team motivation. • Manage project communication, both internal to the team, and external to other project stakeholders. • Initiate projects, including project selection and defining project scope. • Manage project resources, including human resources, capital equipment, and time. • Manage project quality, including the identification of the threats to project quality, techniques for measuring project quality, and the techniques for ensuring project quality is achieved. • Manage project risk, including the identification of project risk, and the techniques for ensuring project risk is controlled.

			• Manage project execution, including monitoring project progress and managing project change, and appropriately documenting and communicating project status.
	7. INDIVIDUAL EDUCATIONAL TRAJECTORIES		
IET 1	Object Oriented Programming Prerequisites: Algorithms, Data structures and Programming	Course objective. Modern level of engineering work requires a good knowledge of computer technology and the ability to use it in their practice. One of the main requirements to specialists in the field of automated control systems is the ability to program and knowledge of programming languages. Objectives of the course is a study of bases of algorithmization of tasks and technologies of programming in host procedural-oriented algorithmic language, classification of programming, bases of programming, methods of development, debugging and test of the programs, structured, visual and object-oriented languages.	Knowledge: • the principles of object-oriented programming, different foundations processing applications today for Windows system interface; • be able to use the mathematical apparatus and information technology developing applications for Windows systems; • to build mathematical models of physical processes; to develop applications for Windows using • databases; • have basic skills in a visual programming environment (Delphi, C++, C#).
IET 1	Real Times Systems Prerequisites: IT Infrastructure	Course objective. The real-time Computer Systems course aims to enable students to acquire the ability to design industrial applications by understanding the temporal requirements and using the appropriate programming languages and operating systems to facilitate the design and development process. It is also intended that the student is able to analyze a real-time system and be able to determine if it will meet the temporary restrictions imposed	• Applied knowledge of industrial computing and communications. • Ability to design control systems and industrial automation. • Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of Industrial Engineering.
IET 1	IIS software engineering Prerequisites: Fundamentals of information systems	Course objective. Software affects us to an ever-increasing extent, both within industry and in our daily lives. Software Engineering deals with the design and development of high-quality software systems and is thus an increasingly important area of computer science. The course block in Software Engineering gives you knowledge and practical skills in the development of	Knowledge: the students will acquire knowledge, competence and experience in the development of software and software-intensive systems in a global perspective, and thereby develop the ability to understand, design and implement such systems in the global market. Skill: On completion of the course block the student shall:

		software systems of high quality, which is invaluable for software architects, project managers and technical specialists.	• analytically apply general principles of software development in the development of complex software and software intensive systems; • demonstrate the necessary understanding of methods and techniques for software management, and also to be able to use these in various development situations; • master general principles and techniques for dealing with quality attributes for various types of software systems (e.g. security and reliability); • understand, plan and carry out independent work within various application domains; • transcend cultural, social and financial differences and work in international teams, proactively plan and manage one's future career, as well as personal development; • reflect oneself and critically evaluate one's own ability to deal with complex problems; • search for, read, understand and evaluate research articles and thus be aware of the research front in software development.
IET 1	Artificial Intelligence Prerequisites: Mathematics III	Course objective. The course is devoted to the basic concepts of artificial intelligence systems. The course examines the architecture of systems of artificial intelligence, pattern recognition system, issues of adaptation, learning and self-learning AI systems, perceptrons, methods and algorithms for the analysis of multidimensional data structures, informal procedures, algorithmic model, fundamentals Prolog language, key concepts of binary trees, the basic concepts expert systems, automated synthesis.	Knowledge: • the location of declarative programming paradigm in the general classification of programming tools, mathematical foundations of logic programming apparatus λ-calculus and Horn clauses, syntax and semantics of Prolog, methods of logic programming; • be able to carry out development and debugging of programs written in Prolog using basic structures and methods of logic programming, develop a simple database, the decision tree; • have an understanding of current and future directions of application of logic programming.
IET 1	Robotic systems	Course objective. The subject presents basic concepts related to robot control and programming. The student is	• Knowledge of automatic regulation and control techniques and its application to industrial automation.

	Prerequisites: Mathematics I, Mathematics II, Physics, Industrial Computing	expected to know how to design and model a robotic system. Also, it is intended that the student apply knowledge of automatic control to the control of robots arms. In this sense we approach concepts of control of a robot arm using conventional techniques and some advanced control techniques. Without leaving the real point of view of industrial robotics, there are also concepts of programming an industrial robot using conventional techniques and some advanced programming techniques. To promote certain qualities such as creativity, constancy, decision-making ability and collaboration to work as a team, the focus of the subject has a marked practicality.	• Knowledge of principles and applications of robotic systems. • Ability to work in a multilingual and multidisciplinary environment.
IET 2	Business process management Prerequisites: Business I	Course objective. This course discusses the processes, methods, techniques and tools that organizations use to manage their information systems projects at business. The course covers a systematic methodology for initiating, planning, executing, controlling, and closing projects. This course assumes that project management in the modern organization is a complex team based activity, where various types of technologies (including project management software as well as software to support group collaboration) are an inherent part of the project management process. This course also acknowledges that project management involves both the use of resources from within the firm, as well as contracted from outside the organization.	Students will learn to • Understand the foundations of business project management, including its definition, scope, and the need for project management in the modern organization. • Understand the phases of the business project management lifecycle. • Manage business project teams, including the fundamentals of leadership and team motivation. • Manage project communication, both internal to the team, and external to other project stakeholders. 6. Initiate projects, including project selection and defining project scope. • Manage project resources, including human resources, capital equipment, and time. • Manage project quality, including the identification of the threats to project quality, techniques for measuring project quality, and the techniques for ensuring project quality is achieved. • Manage project risk, including the identification of project risk, and the techniques for ensuring project risk is controlled.

			• Manage project execution, including monitoring project progress and managing project change, and appropriately documenting and communicating project status.
IET 2	Database Administration Prerequisites: Database in IS	Course objective. Database administration skills covering installation, configuration and tuning a database, administering servers and server groups, managing and optimizing schemas, tables, indexes, and views, creating logins, configuring permissions, assigning roles and performing other essential security tasks, backup and recovery strategies, automation and maintenance. Course Goals: • Provide students with the opportunity to build upon the knowledge learned in Database Systems. • Prepare students for an entry-level database administration position. • Demonstrate to students how to manage database services and clients. • Demonstrate to students how to implement and configure a database environment. • Explain to students best practices for data management. • Demonstrate and apply database optimization, maintenance and recovery procedures.	Knowledge: • properly install, configure and tune a database; • properly administer servers and server groups; • properly manage and optimize schemas, tables, indexes, and views; • properly create logins, configure permissions, assign roles, and perform other essential security tasks; • properly monitor server activity and resolve performance issues; • take charge of automation and maintenance; • plan and implement a comprehensive backup and recovery strategy; • import, export and transform data from various sources; • implement replication and data merging • manage data publications and subscriptions.
IET 2	Network administration Prerequisites: IT Infrastructure	Course objective. The curriculum provides an introduction to the basic principles of management and skills needed for the installation, troubleshooting and monitoring of network devices to maintain integrity, confidentiality and availability of data and devices. Students receive in-depth theoretical knowledge with the principles of network management information systems, as well as with the available tools and configurations. The course focuses on the practical application of the skills needed to design, implement and support network.	Knowledge: • the basic concepts and network administration technologies. • tools for the development of networks and Internet use, as well as hardware specific to home networks and networks of small businesses. • administration and monitoring local computer networks, which are considered the key principles underlying the basis of the routing, remote access, addressing and network services. • to design and configure the network routers.

		Practical laboratory classes help students develop critical thinking skills to solve complex problems.	• to design a network on Windows Server • to use protocols for increased performance LAN and WAN.
IET 2	Standards of IIS service Prerequisites: Fundamentals of information systems	Course objective. The course is devoted to the basic concepts of IIS service standards and includes next chapters: Planning and Implementing Service Management. Planning and implementing new or changed services. Processes Service. Service Level Management. Formation of and reporting on services. Service Continuity Management and Availability. Budgeting and accounting for the cost of IT services. Capacity Management. Information Security Management. Group relations processes. Business Relationship Management. Contractor Management. Incident management. Problem Management. Configuration management. Change management. Release management.	Knowledge: • Planning and Implementing Service Management. • Planning and implementing new or changed services. • Processes Service. Service Level Management. • Formation of and reporting on services. Service Continuity Management and Availability • Budgeting and accounting for the cost of IT services. Capacity Management • Information Security Management. Group relations processes • Business Relationship Management. Contractor Management • Incident management. Problem Management. Configuration management. Change management. Release management. Skills: To able make and solve questions of IIS service via using of standards
IET 2	Cloud technology Prerequisites: IT Infrastructure	Course objective. After completing this seminar, participants will be able to: • Discuss, with confidence, what is cloud computing and what are key security and control considerations within cloud computing environments. • Identify various cloud services. • Assess cloud characteristics and service attributes, for compliance with enterprise objectives. • Explain the four primary cloud category “types”. • Evaluate various cloud delivery models. • Contrast the risks and benefits of implementing cloud computing.	Knowledge: You will gain skills as you apply knowledge effectively in diverse contexts. Skill: You will learn to accurately and objectively examine and consider computer science and information technology (IT) topics, evidence, or situations, in particular to: analyze and model requirements and constraints for the purpose of designing and implementing software artefacts and IT systems Problem Solving: Your capability to analyze problems and synthesize suitable solutions will be extended as you learn to: design and implement software solutions that accommodate specified requirements and constraints, based on analysis or modelling or requirements specification.

		• Specify security threat exposure within a cloud computing infrastructure. • Recognize steps and processes used to perform an audit assessment of a cloud computing environment. • Summarize specific environments that would benefit from implementing cloud computing, contrasted against those environments that might not benefit. • Weight the impact of improperly controlled cloud computing environments on organizational sustainability.	Communication: You will learn to communicate effectively with a variety of audiences through a range of modes and media, in particular to: present a clear, coherent and independent exposition of software applications, alternative IT solutions, and decision recommendations to both IT and non-IT personnel via technical reports of professional standard and technical presentations. Team Work: You will learn to work as an effective and productive team member in a range of professional and social situations, in particular to: work effectively in different roles, to form, manage, and successfully produce outcomes from teams, whose members may have diverse cultural backgrounds and life circumstances, and differing levels of technical expertise.
8.INTERDISCIPLINARY MODULE			
M	Innovative entrepreneurship (by industry) Prerequisites: no	Course objective. The objective of this course is formation of a complex knowledge of the principles of the organization of innovative processes, the study of the role of innovation as a decisive factor in the dynamic development of the economy. Tasks: • familiarize students with the basic concepts, categories, laws and the laws of development of entrepreneurship; • Development and strengthening of practical skills and analytical uses of information for the scientific substantiation of the strategy and tactics of development of business in the present and in the future. • to disclose the nature and specifics of the basic functioning of business arrangements; • on the basis of theoretical knowledge to develop practical skills for studying and evaluation of socio-economic role of business development trends.	Knowledge: • the role of entrepreneurship in economic development; • basic forms and types of businesses; • planning framework, organization and management of the enterprise; • culture and ethics of the entrepreneur. Skill: • to carry out an economic analysis of the industry as a whole in terms of knowledge about the profession to discuss the relevant conditions; • investigate and disclose the nature of the economy.
M	Intellectual rights Prerequisites: no	Course objective. The purpose of this course is to study the legal relations in the Republic of Kazakhstan, the introduction to the special part of the Civil Code, clarification of concepts,	Knowledge:

		categories, definitions of intellectual law for the resolution of legal disputes in the courts, arbitration courts, and the legal service which are connected to the issues of intellectual property. The course reveals the legal regime of the full range of intellectual property relations in all its facets, by bringing information from the theory of law and the practice of law by the courts, prosecutors, notaries, arbitration courts and legal service.	• In the course "Intellectual Law" a student must know the content of intellectual law in order to apply this knowledge in practice. • The student must have an understanding of the procedure and features of the application of intellectual law to certain legal situations. Skill: • Student must also acquire practical skills of interpretation of intellectual law, applying them to specific legal situations.
M	Accounting and audit Prerequisites: no	Course objective. The objective of this course is to study of theoretical, methodological, legal and organizational bases of accounting; the study technology and methodological features of inspection and examination of financial and economic information, internal control systems and analysis of the assets, equity and liabilities; generalization of progressive experience in advisory and other audit identification of reserves and the development of recommendations to optimize performance and improve the effectiveness of the audited objects.	Knowledge: • provisions and regulations on accounting; • information on individual sections of accounting (from primary documents to accounting). Skill: • filling and processing accounting documents; • on a specific date to make a balance; • open accounts of the synthetic and analytical accounting; • make accounting entries related to business operations of the organization; • record business transactions, to reflect them in the relevant accounting records.
M	Econometrics Prerequisites: no	Course objective. The objective of this course is to study the basics of quantitative analysis of actual economic phenomena based on the modern development of the theory and observation of laws and dependencies, test the postulated relationship. In course students will consider the problems of quality assessments built econometric dependencies, identify autocorrelation and heteroscedasticity, the specification of variables and the type of dependency.	Knowledge: • the basics of regression analysis; • the foundations of statistical estimation and analysis of the accuracy of the parameters of the regression equation; basic prerequisites for the proper application of the classical regression models; • analysis of the foundations of econometric models, representing a system of simultaneous equations; analyzing and forecasting time series. Skill:

			• to apply basic knowledge it to the investigation of economic relationships and processes, and also understand the econometric methods, approaches, ideas, results and conclusions met in the majority of economic books and articles; • the students should understand essential differences between the time series and cross sections data and those specific econometric problems met in the work with these types of data, as well as with panel data, and apply the appropriate econometric methods; • the students should get the skills of construction and development of simple and multiple regression models, get acquainted with some non-linear models and special methods of econometric analysis and estimation, understanding the area of their application in economics; • the considered methods and models should be mastered practically on real economic data bases with modern econometric software.
M	Geoinformatics Prerequisites: no	Course objective. The objective of this course is obtaining knowledge and expertise in the field of computer science, modern computer and information technologies, GIS and methods of creating and using geographic information systems (GIS), the development of methodological and practical skills in implementation, based on the knowledge and geographical research skills.	Knowledge: • the theoretical foundations of Geoinformatics and modern geoinformation technologies; • functions of geographic information systems; • basic ideas, principles and methods of use of GIS in geosciences. Skill: • use the skills to work with information from various sources to solve professional problems, to evaluate the effectiveness of GIS in solving geographical problems.
M	Latin Prerequisites: no	Course objective. The objective of this course is learning basics of Latin grammar, the general concept of the structure of the language in its relationship to language learners, as well as familiarize with culture-concepts directly related to linguistic phenomena. Task:	Knowledge: • rules of pronunciation of letters and combinations of letters of the Latin language, as well as the rules of the stress formulation in Latin words; • know by heart a certain number of well-known Latin proverbs, sayings, winged words and expressions.

		• training those elements of Latin grammar, which are required for understanding and proper use of terms in the Latin language; • acquire the skills of correct pronunciation and regulatory reading; • ensure assimilation by students of grammatical and lexical minimum; • to form students' ability to be translated into Latin and vice versa.	Skill: • determine grammatical categories of all types of studied words (noun, verb, adjective, pronoun, participle); • adapted to translate educational texts with the help of a dictionary and grammar reference books.
M	Culture of Speech and Language Communication Prerequisites: no	Course objective. The objective of this course is study of stylistic and linguistic features of scientific style of speech; types of scientific information contained in the texts in the specialty; methods of structural and semantic analysis and compression of educational and scientific texts. Tasks: • to acquaint with the structural and semantic organization of scientific text; • learn to identify the basic and additional information text; • learn how to extract from the text of the relevant information to describe, summarize it with a view to use in the process of teaching and professional communication; • develop the skills and the ability to read scientific literature in the specialty for the formation of professional competence; • analyze and compression of educational and scientific texts; • develop the ability to build oral and written statement; • to perform an oral presentation; properly conduct educational dialogue, to take part in the debate.	Knowledge: • structural and semantic organization of the text in the specialty; • different norms of the literary language; • have an understanding of speech as an instrument of effective communication and the basics of oratory. Skill: • use the rules of modern literary language, expressive language means in different contexts of communication; • build various kinds of monologue and dialogue speech.
M	Al-Farabi and Contemporaneity Prerequisites: no	Course objective. The objective of this course is general knowledge on Turkic thinker Al-Farabi, his scientific-philosophical heritage and its significance for contemporaneity. Course objectives:	Knowledge: • philosophical aspects and methodological approaches to the study of actual problems of al-Farabi heritage; • fundamental questions of the origin and evolution of actual problems of al-Farabi heritage.

		• to give to Master's degree students knowledge on life and work of Al-Farabi; • to get features of Al-Farabi's logic, gnoseology, ontology, naturephilosophy and other philosophic studies and his place in the scientific world; • to explain feature of scientific innovative project "Al Farabi university smart city"; • to get necessity of Al-Farabi's social-ethics school for contemporaneity.	Skill: • use of traditional knowledge of the professional activity of topical issues of Al-Farabi heritage; • master of conceptual thinking culture heritage of Al-Farabi; • to own techniques and methods of oral and written presentation of the basic philosophical knowledge of al-Farabi Kazakh National University; • to work with the texts of the heritage of Al-Farabi and the contained semantic structures; • develop the ability to abstracting and annotation of literature (including in foreign languages) on topical issues of al-Farabi heritage.
9. PRACTICE			
	Professional practice (by types of practice)		
	Educational Practice	The purpose of educational practice is the solution of tasks in programming languages of the subjects considered during a semester as material fixing, and also on subjects not passed, as increasing knowledge on programming earlier.	The objectives of the educational practice are:- fixing of knowledge of programming gained during training; • increasing knowledge on programming; • to master algorithms of various tasks of programming; • to teach to solve various problems of Programming languages n programming languages.
	Practice Training	The purpose of practice is to pre-testing of the developed software and the formation of the proposals, but to implement them immediately in the workplace.	The objectives of the practical training are:- acquaintance with structure the entity and its departments, the principles of management and job managements at the entity; • acquaintance with a technique of statement and the solution of production and economic tasks in the conditions of forming of market economy; • profound practical studying of the information technologies applied at the entities to handling of information; • studying of methods of designing and development program providing in computer center the entity; • participation in maintenance and operation of the information systems used at the entity; • studying and matching of materials; • acquisition of skills of production and organizing work.

	Pre-diploma Practice	Pre-diploma practice of students is an important part of training and conducted in accordance with the basic specialty curriculum. The main purpose of pre-diploma practice is to provide theoretical and practical results that are sufficient for the successful implementation and protection of final qualifying work. It helps to perpetuate and deepen students' theoretical knowledge obtained during the training, and the ability to set goals, analyze the results and draw conclusions, the acquisition and development of skills of independent research work.	As a result of the passage of pre-diploma practice student must know: • market information resources and especially their use; • principles of information security; • industrial technology design of information systems; • demands on the reliability and efficiency of industrial information systems; • prospects for the development of industrial information systems; • methods of research in the theory, technology development and operation of industrial information systems; • information systems in related subject areas; • the basic principles of the organization of industrial information systems. To be able to: • formulate and solve problems of industrial design information systems using a variety of techniques and solutions; • set the task of system design and aggregation of local and global networks of service users of information systems; • formulate and solve problems related to the organization of a dialogue between a person and an information system; • to carry out the choice of interface tools in the construction of complex industrial information systems; • formulate the basic technical and economic requirements for the projected industrial information systems; • create industrial information systems; • develop pricing applications of information systems in the domain.

CONLUSIONS OF EXPERTS