Non-profit joint-stock company «Kazakh National Research Technical University named after K.I. Satbayev»
Institute of Information and Telecommunication Technologies
Department of «Software Engineering»

Educational program

"SOFTWARE ENGINEERING"

Master of Technical Sciences

based on the following specialties of the invalidated classifier of specialties:
«6M070400»

1st edition
in accordance with the state standard of higher education 2018

Almaty 2019

САТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

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Квалификация:
Уровень 7 Национальной рамки квалификаций:
7М0610 Информационно- коммуникационные технологии

Профессиональные компетенции: Разработка программного обеспечения, Распределенные вычисления и хранилища данных.

Brief description of the program

The main focus of the master's program is on in-depth study of software development technologies, understanding the architecture of computing systems, and expanding knowledge in the field of paradigms for developing distributed, resilient network applications.

The program is aimed at training a high-quality specialist in accordance with the level of competence who is able to independently conduct scientific research, independently develop complex software solutions, work in a team, and navigate modern Information Technologies. The educational program is structured taking into account the current trends in software development and in close relationship with the manufacturing sector.

The development of the educational program was carried out on the basis of 3 documents defining directions and specialization in the field of IT - SWEBOK, the purpose of which is to combine knowledge of software engineering; SE2004 - Study Guide for the Training of University Programs in Software Engineering; CC2005 Guidelines for curriculum development for IT professionals. A team of international IT specialists has identified a set of areas of study and a set of disciplines that provide quality training in IT (CC2005), as well as a thematic composition of disciplines and a set of knowledge necessary and sufficient for IT specialists (SWEBOK, SE2004).

This educational program " Software Engineering" is developed on the basis of the main regulatory documents:

- State obligatory standard technical and vocational education, approved by the Decree of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080 (with changes as of August 15, 2017). Footnote. Clause 1 as amended by the decrees of the Government of the Republic of Kazakhstan dated 25.04.2015 No. 327 (shall be enforced from 09/01/2016); dated 13.05.2016 No. 292 (effective from 01.09.2017).
- Sectoral Qualifications Framework (SQF). Industry: information and communication technologies. Approved by Minutes No. 1 dated December 20, 2016 of the meeting of the Industry Commission in the field of information, informatization, communications and telecommunications.
- The Law of the Republic of Kazakhstan "On Education" dated July 27, 2007 No. 319III ЗРК;
- IEEE SWEBOK pooling knowledge of software engineering;
- CC2005 guidelines for developing curriculum for IT professionals;
- SE2004 educational leadership for preparation specialists university programs in software engineering.

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

The educational program was developed based on the analysis of the labor functions of software engineers, system administrators, data analysts, declared in professional standards.

Representatives of Kazakhstani companies in the field of software development participated in the development of the educational program.

The program focuses on the following areas of professional activity:

- Software development
- Distributed computing and data warehouses

Content of the educational program:

- General educational complex of disciplines
- Disciplines of software development methodologies
- Disciplines of development of distributed network applications
- Disciplines of development of distributed databases
- Disciplines of software development project management

During the study, production practices are provided in leading IT companies located in the Republic of Kazakhstan and training abroad as part of academic mobility.

PASSPORT OF THE EDUCATIONAL PROGRAM

1. **Scope and content of the program**

The term of study in the master's program is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. In the scientific and pedagogical magistracy, at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master student.

Planning the content of education, the way of organizing and conducting educational process carried out University and scientific organizationindependently based on credit technology of education.

The master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the preparation of scientific and scientific and pedagogical personnel for universities and scientific organizations that have in-depth scientific and educational and research preparation.

The content of the Master's degree program consists of:

1) theoretical training, including the study of cycles of basic and major disciplines;
2) practical training of undergraduates: various types of practices, scientific or professional internships;
3) research work, including the implementation of a master's thesis - for a scientific and pedagogical magistracy
4) final certification.

The purpose and objectives of the educational program

Provide practice-oriented training specialists engineering and scientific activities in the field of software development, able to apply various technologies, knowledge and skills of software development and design activities with a focus on in-depth study of the aspects of creating distributed computing systems and a detailed study of the hardware limiting factors of computers.

To prepare specialists in engineering and scientific activities and production for production and technological activities related to the process of development and modification of software products, focused on meeting the expectations and requirements of users, for organizational and management activities related to the maintenance of software products of various classes and categories, management of information systems.

Create a conditions for continuous professional self-improvement, development of social and personal competencies (wide cultural outlook, active citizenship, dedication, organization, hard work, sociability, ability to argumentation and adoption of organizational and managerial decisions, possession of modern information technologies, free possession several languages, striving for self-development and adherence to ethical values and a healthy lifestyle, the ability to work in a team, responsibility for the end result of one's professional activity, civic responsibility, tolerance), social mobility and competitiveness in the labor market.

Education level: high
Qualification levels for NQF/ORK: Covers 8 levels.
Professional area *: technical sciences and technologies

Labor activities:
- design and engineering;
- production and technological;
- experimental research;
- organizational and managerial;
- operational;
- scientific.

Objects of professional activity:
- Computing machines, complexes, systems and networks;
- Computer systems for information processing and control;
- Automated control systems;
- Computer software;

Features of the program **:** academic exchange program / credit training system / distance learning
Form of study: full-time
Duration of study: 2 years
Language of study: Kazakh, Russian, English.

2. Requirements for applicants

Prior level education applicants - higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for admitting citizens to a magistracy is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

3. Requirements for Completion and Diploma

Awarded degree/ qualifications: Graduate given the educational program is awarded the academic degree of master of technical sciences.

A graduate who has completed master's programs must possess the following general professional competencies:

- ability by yourself acquire, comprehend structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice the knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern scientific and technical equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- the readiness for communication in oral and written forms in a foreign language to solve the problems of professional activity.

A graduate who has mastered the master's program must have professional competencies, appropriate types professional activities for which the master's program is focused:

research activities:

- ability to form diagnostic solutions of professional tasks by integration fundamental sections sciences and specialized knowledge gained during mastering the master's program;
- ability to independently conduct professional research, experimental information, conclusions and recommendations;
- the ability to create and explore models of objects under study based on the use of in-depth theoretical and practical knowledge in the field of software development;

-research and production activities:

- the ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;
- the ability to professionally operate modern field and laboratory equipment and instruments in the field of the mastered master's program;
- ability use modern methods processing and interpretation of complex information for solving production problems;
- *project activity:*
- the ability to independently compose and submit projects for research and development work;
- readiness to design complex research and development work in solving professional problems;
- *organizational and management activities:*
- the readiness to use the practical skills of organizing and managing research and development work in solving professional problems;
- the readiness for the practical use of regulatory documents in the planning and organization of scientific and industrial work;
- *scientific and pedagogical activity:*
- the ability to conduct seminars, laboratory and practical exercises;
- the ability to participate in the management of scientific and educational work of students in the field of software development.

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

4. Working curriculum of the educational program

4.1. Study period 2 year

Year of study	Code	Name of discipline	Component	Credits		lec/lab/pr	Pre-requisites	Code	Name of discipline	Component ECTS	Credits		ec/lab/pr	Pre-requisites
				ECTS	RK						ECTS	RK		
	1 semester								2 semester					
1	LNG 205	Foreign language (professional)	DB VK	5	3	0/0/3		CSE 261	Theory of Complexity & Computations	DB VK	5	3	2/0/1	
	HUM 201	History and philosophy science	DB VK	4	2	1/0/1		CSE 289	Object Oriented Design Patterns	DB VK	5	3	2/0/1	
	HUM 205	Pedagogy high school	DB VK	4	2	1/0/1		CSE 270	QA/QC and Continuous Integration	PD VC	5	2	2/0/1	
		Psychology of management	DB VK	4	2	1/0/1		CSE 424	Technology development software provision for systems real time	PD KV	4	2	1/0/1	
	CSE 286	Computer Architecture & Concurrency	DB KV	5	3	2/0/1		CSE 290	CAP & ACID Fundamentals	PD KV	4	3	1/0/1	
	CSE 287	Software Engineering Project Management	PD VK	5	3	2/0/1			Scientific research work of master student	RW MS	7	2		
		Pedagogical i practice	DB VK	3	3									
		Total:		**30**	**18**				**Total:**		**30**	**15**		
	3 semester							4 semester						
2	CSE 306	Big Data Storage Systems & Computations	PD KV	5	3	2/0/1			Scientific research work of master student	RW MS	9	2		
	CSE 285	Microservices and Cloud Computing	PD KV	5	3	2/0/1			Research practice	PD	9	2		
	CSE 291	High load distributed computing	PD KV	4	2	1/0/1			Registration and Master's thesis defense (OIMD)	IA	12	3		
	CSE 225	Applied Information Theory	PD KV	4	2	1/0/1								
	CSE 309	Machine Learning & Deep Learning	PD KV	4	2	1/0/1								
		Scientific research work of master student	RWMS	8	2									
		Total:		**30**	**14**				**Total:**		**30**	**7**		
									Total:		**120**	**73**		

5. Descriptors of the level and amount of knowledge, abilities, skills and competencies

The requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's degree) and reflect the acquired competencies expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) demonstrate evolving knowledge and understanding in the field of software development under study, based on advanced knowledge of the field, when developing and / or applying ideas in the context of research;
2) apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a broader interdisciplinary context;
3) collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;
4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;
5) learning skills necessary for independent continuation of further education in the studied area.

6. Completion Competencies

6.1 Requirements for key competencies of graduates scientific and pedagogical magistracy, must:
1) have an idea:
- on the role of science and education in public life;
- about modern trends in the development of scientific knowledge;
- about relevant methodological and philosophical problems
natural (social, humanitarian, economic) sciences;
- about the professional competence of a higher school teacher;
- about the contradictions and socio-economic consequences of globalization processes;
2) know:
- methodology of scientific knowledge;
- principles and structure of the organization of scientific activity;
- psychology of students' cognitive activity in the learning process;
- psychological methods and means of increasing the efficiency and quality of education;
3) be able to:
- use the knowledge gained for the original development and application of ideas in the context of scientific research;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;
- to apply knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- spend information and analytical and informational bibliographic work using modern information technologies;
- to think creatively and be creative in solving new problems and situations;
- be fluent in a foreign language at a professional level, allowing for scientific research and teaching of special disciplines in universities;
- summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;
4) have skills:
- research activities, solutions to standard scientific tasks;
- implementation of educational and pedagogical activities on credit technology of education;
- methods of teaching professional disciplines;
- use modern information technologies in educational process;
- professional communication and intercultural communication;
- oratory, correct and logical design of your thoughts in oral and written form;
- expansion and deepening of knowledge necessary for daily professional activities and continuing education in doctoral studies.
5) be competent:
- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activities in higher educational institutions;
- in matters of modern educational technologies;

- in the implementation of scientific projects and research in the professional field;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

B - Basic knowledge, skills and abilities;

B1 - Architecture and types of computers;
B2 - Operating systems;
B3 - Programming languages;
B4 - T e technologies of programming;
B5 - Database models;
B6 – Methods for organizing authorized access to data;
B7 - Computer systems interaction protocols;
B8 - Interprocessor communication architectures;
B9 - Business process automation methods;
B10 - Models and types of data analysis;
B11 - Principles and models of artificial intelligence;
B12 - Techniques for modeling, composition and decomposition of systems;
B13 - The principles of consistency and integrity;
B14 - Systemic / structural analysis methods;
B15 - Software life cycle;
B16 - UML - as a basic tool for describing technical systems;
B17 - SQL - as a basic data management tool;
B18 - Typical architectures of information systems / software;
B19 - Types of software;
B20 - Process design methods;
B21 - Methods of designing software interfaces;
B22 - Software design / development / debugging / maintenance tools;
B23 - Basic algorithms and data structures;
B24 - Standards, methodological and regulatory materials for software development;
B25 - Methods and models of scientific activity;
B26 - Basic approaches, tools and models for project management;
B27 - Standards for building IT infrastructure;
B28 - About trends in IT;
B29 - On the applicability of tools and technologies for solving the problem;
B30 - About the adequacy of the designed model;
B31 - On the effectiveness of the methods and models used;

P - Professional competencies:

P1 - Analysis of the subject area, definition of goals and ways to achieve them;
P2 - Determining the timing of tasks and the formation of technical specifications;
P3 - Formalization of the task, prioritization of implementation;
P4 - Selection of optimal solutions to problems;
P5 - Planning the stages of the project;
P6 - Modeling the structure of the subject area;
P7 - Determination of functional and operational requirements for system components;
P8 - Using UML standards to represent technical documentation, diagrams, models;

P9 - Keeping protocols of the project;
P10 - Formation of reporting documentation;
P11 - Database model design;
P12 - Develo and design of software interfaces;
P13 - Construction of algorithms for computing processes;
P14 - Writing / testing / debugging / maintenance / integration of program codes and products;

O - Human, social and ethical competences

O1 - Possess knowledge of the historical, cultural and scientific achievements of the Republic of Kazakhstan; use data from historical sources and special literature; analyze and evaluate historical facts and events.
O2 - Have a broad social, political and professional outlook
O3 - Have an idea of the subject, functions, main sections and directions of philosophy; place and role of philosophy in the life of society and individuals, apply knowledge of philosophical and methodological principles of cognition in professional activities
O4 - Think logically, master the methods of induction and deduction, determine cause-and-effect relationships; master the methods of decomposition, analysis and synthesis of O5 systems - Knowledge of Kazakh, Russian, foreign languages. Be able to work with scientific and technical literature in Kazakh, Russian and foreign languages; search for scientific and technical information; understand the information provided at a normal pace, with the subsequent transfer of its content. Conduct an intercultural dialogue, develop and deepen their knowledge, be open to new information; set professional contacts and develop professional communication in a foreign language, carry out business contacts in a foreign language, know the terminology, read literature on the specialty in a foreign language
O6 - Plan the stages of scientific research, organize searches and select relevant information
O7 - To structure and edit information, prepare technical and scientific documentation in accordance with existing requirements;
O8 - Be able to reasonably and clearly build oral and written speech, explain your view of the problem.
O9 - Ability to critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena.
O10 - Application of knowledge of pedagogy and psychology of higher education in their pedagogical activities, the use of interactive teaching methods.
O11 - Ability to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.

C - Special and managerial competencies:

C1 - Ability to set goals and plan ways to achieve them;
C2 - Ability to conduct project/ operational activities;
C3 - Ability to conduct scientific research;
C4 - The ability to organize the work of the IT department;
C5 - Ability to organize work on the collection, storage and processing of information used in the field of professional activity.

6.2 Requirements for the research work of a master student in a scientific and pedagogical magistracy:

1) corresponds to the profile of the master's educational program, according to which the master's thesis is performed and defended;
2) is relevant and contains scientific novelty and practical significance;
3) is based on modern theoretical, methodological and technological achievements of science and practice;
4) is carried out using modern scientific research methods;
5) contains research (methodological, practical) sections on the main protected provisions;
6) is based on advanced international experience in the relevant field of knowledge.

6.3 Requirements for organizing practices:

The educational program of the scientific and pedagogical magistracy includes two types of practices, which are carried out in parallel with theoretical training or in a separate period:
1) pedagogical in the DB cycle - at the university;
2) research in the PD cycle - at the place of the dissertation.

Pedagogical practice is carried out with the aim of developing practical skills in teaching and learning methods. In this case, undergraduates are involved in conducting classes in a bachelor's degree at the discretion of the university.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

7. ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European annex is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma is required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

8. Description of disciplines

English (professional)
CODE – LNG205
CREDIT - 5

PURPOSE AND OBJECTIVES OF THE COURSE

Thanks to this course, you will master specific terminology, be able to read specialized literature, gain the knowledge necessary to implement effective oral and written communications in a foreign language in your professional activities.

SHORT DESCRIPTION OF THE COURSE

In the process of training, students acquire knowledge of a foreign language, including mastery of specialized vocabulary, necessary for the implementation of effective oral and written communications in a foreign language in their professional activities. Practical tasks and methods for developing the required language skills in the learning process include: case method and role-playing games, dialogues, discussions, presentations, listening tasks, working in pairs or in groups, completing various written tasks, grammar tasks and explanations.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of mastering the discipline, the student expands the professional lexical vocabulary, possess the skills of effective communication in a professional environment, the ability to competently express thoughts in oral and written speech, understand specific terminology and read specialized literature.

History and philosophy of science

CODE – HUM201
CREDIT - 4

PURPOSE AND OBJECTIVES OF THE COURSE

To reveal the connection between philosophy and science, to highlight the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of the philosophy of science, modern problems of the development of scientific and technical reality.

SHORT DESCRIPTION OF THE COURSE

The subject of philosophy of science, dynamics of science, specificity of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, technology and technology, specificity of engineering sciences, ethics of science , social and moral responsibility of a scientist and engineer.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Know and understand the philosophical issues of science, the main historical stages in the development of science, the leading concepts of the philosophy of science, be able to critically assess and analyze scientific and philosophical problems, understand the specifics of engineering science, possess the skills of analytical thinking and philosophical reflection, be able to substantiate and defend one's position, master techniques conducting discussion and dialogue, possessing the skills of communication and creativity in their professional activities.

Higher education pedagogy

CODE – HUM205
CREDIT - 4

PURPOSE AND OBJECTIVES OF THE COURSE

The course is aimed at studying the psychological and pedagogical essence of the educational process of higher education; formation of ideas about the main trends in the development of higher education at the present stage, consideration of the methodological foundations of the learning process in higher education, as well as psychological mechanisms affecting the success of learning, interaction, management of subjects of the educational process. The development of psychological pedagogical thinking of undergraduates.

SHORT DESCRIPTION OF THE COURSE

In the course of studying the course, undergraduates get acquainted with the didactics of higher education, forms and methods of organizing education in higher education, psychological factors of successful learning, features of psychological influence, mechanisms of educational influence, pedagogical technologies, characteristics of pedagogical communication, mechanisms of managing the learning process. Analyze organizational conflicts and ways to resolve them, psychological destruction and deformation of the teacher's personality.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

the end of the course, the undergraduate must know the features of the modern system of higher professional education, the organization of pedagogical research, the characteristics of the subjects of the educational process, the didactic foundations of the organization of the learning process in higher education, pedagogical technologies, the patterns of pedagogical communication, the features of educational influences on students, as well as the problems of pedagogical activity.

Philosophy of management

CODE
CREDIT - 4

PURPOSE AND OBJECTIVES OF THE COURSE

The main goal of the course is aimed at studying the characteristics of the behavior of individuals and groups of people within organizations; determining psychological and social factors influencing the behavior of workers. Also, much attention will be paid to issues of internal and external motivation of people.

The main goal of the course is to apply this knowledge to improve the effectiveness of the organization.

SHORT DESCRIPTION OF THE COURSE

The course is designed to provide balanced coverage of all the key elements that make up the discipline. It will briefly review the origins and development of the theory and practice of organizational behavior, followed by a review of the main roles, skills and functions of management with a focus on management effectiveness, illustrated with real-life examples and case studies.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will know: the basics of individual and group behavior; basic theories of motivation; basic leadership theories; concepts of communication, management of conflicts and stress in the organization.
will be able to define the different roles of leaders in organizations; look at organizations from the point of view of managers; understand how effective management contributes to an effective organization.

ComputerArchitecture & Concurrency

CODE – CSE286
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

Acquaintance with the basic theoretical and practical aspects of computers. Disclosure of the features of the system level software. Current state of operating systems, limiting factors, and consistency issues in multitasking systems. The objective of the discipline is to obtain systematized knowledge about the composition and principles of managing VMs, systems and networks, about the purpose of the components of operating systems, the principles of functioning of various elements of operating systems and their interaction, the generation and processing of processes in the system.

SHORT DESCRIPTION OF THE COURSE

The discipline is a natural science discipline, introduces students to the fundamental basics of system programming in Linux OS: tools, low-level input output, multitasking, file system, interprocess interaction and error handling.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Basic concepts of system programming, be able to design programs that cover system software issues.

Will be able to:

- Program work with basic input / output operations;
- Write programs using buffered I / O;
- Work with extended file I / O;
- Work with the file system;
- Work with processes and threads;
- Work with memory;
- Manage interprocess communication

Software Engineering Project Management

CODE – CSE287
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the basic models of project management in relation to software development

Objectives:

- Studying the basic model of Project activity
- Studying project life cycle models
- Studying modern approaches in software development

SHORT DESCRIPTION OF THE COURSE
The concept of "project" unites a variety of activities, characterized by a number of characteristics, the most common of which are the following:
- focus on achieving specific goals, specific results;
- coordinated execution of numerous, interrelated actions;
- a limited extent in time, with a definite beginning and end.

The project was more often used in the construction, engineering and architectural spheres, now this term is used in all spheres of human life. With the advent of the concept of a project, the concept of project management has appeared and is developing in parallel.

In the case of software development, project activities began to develop at a rapid pace and in various directions - from a flexible organization to a strict cascading one. This course will cover the most common Agile approaches - agile models with tight deadlines and fast iterations.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:
Understand
- The concept of project and operational activities
- Project management
- Agile Models - Scrum, XP

Know
- Tools and approaches in the implementation of project activities

Be able to
- Apply models of design activities to implement software products

Theory of complexity & Computations

CODE – CSE261
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the basic elements of the theory of computational complexity.

Objectives:

- Analysis of computational problems and complexity of algorithms
- Analysis of complexity classes of determined algorithms
- Analysis of complexity classes of non-deterministic algorithms
- Analysis of classes of computational algorithms in terms of capacitive complexity

SHORT DESCRIPTION OF THE COURSE

Computational complexity theory is a field of theoretical computer science, one of the main tasks of which is the classification and comparison of the practical complexity of solving problems on finite combinatorial objects. Complexity theory in a number of cases provides answers to questions about the computational and capacitive complexity of algorithms, their relationship to each other. Computational complexity theory introduces the concept of classes of problems in terms of computational complexity, efficient algorithms that solve problems in polynomial time, and others with exponential addiction time solutions from data, considers deterministic and non-deterministic algorithms and their computational complexity.

In particular, considering the problem of determining the prime number of n, we know that it can be solved in time proportional to log (n), at the same time, determining a winning sequence of steps in a chess game is a problem solved by "brute force" or "brute force", which is at least exponentially the same size as the task instance. Complexity theory attempts to clarify such differences by proposing a formal criterion for what it means for a mathematically solvable problem to be feasibly solvable - that is, that it can be solved using a conventional Turing machine in several steps that are proportional to a polynomial function of the size of its input or not polynomial, for example, an exponential function.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, the student will:

Understand

- Concepts of computational and capacitive complexity of algorithms
- classes ofcomplexity of algorithms

Know

- Relationship between complexity classes and the limits of application of the theory of computational complexity
- fundamental differences between problems with different classes of complexity

Be able to

- Apply complexity theory to assess the computational complexity of algorithms

Object Oriented Design Patterns

CODE – CSE289
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to become familiar with well-established design patterns using an object-oriented methodology.

Objectives:

- Exploring design patterns
- Gaining hands-on experience in using design patterns

SHORT DESCRIPTION OF THE COURSE

Object-oriented programming has long been a fundamental methodology for building software. The basic concept of encapsulation, inheritance, polymorphism offers well-established patterns for solving the problem of writing program code. These patterns include Singleton, Proxy, Adapter, Decorator, Strategy, State, Class Factory, Responsibility Chain, and many others. The course examines the tasks that can be solved using these templates, which allows a wide development environment to quickly find a common language and build supported and self-documenting software. The use of design patterns creates the foundation for building a high-tech software development process.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:

Understand

- Object Oriented Design Patterns

Know

- Advantages and Disadvantages of Design Patterns

Be able to

- Apply design patterns to create software

Quality Assurance/Quality Control & Continuous Integration

CODE – CSE270
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the basic elements of the theory of computational complexity.

Objectives:

- Analysis of computational problems and complexity of algorithms
- Analysis of complexity classes of determined algorithms
- Analysis of complexity classes of non-deterministic algorithms
- Analysis of classes of computational algorithms in terms of capacitive complexity

SHORT DESCRIPTION OF THE COURSE

Reliable software is the goal of the programmer and end users. Without special skills and theoretical foundations for testing, it is impossible to release a single software product. The success of a business, the work of financial or industrial companies can depend on the correct functioning of the software. As part of the course, students will gain knowledge in the field of quality assessment, software quality control, learn how to develop test cases, perform testing on test cases, detect errors during testing and document them, evaluate and test a software product in terms of module, functionality, and integration.

KNOWLEDGE, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, learners will:

Understand

- Own terminology
- Understand the software testing process and life cycle software product

Be able to

- Develop test cases (TestCase)
- Detect and document test errors
- Evaluate and test a software product from the point of view functionality

Real-time software development technologies
CODE – CSE244
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the concept of real-time systems.

Objectives:

- Studying the hardware component of real-time systems
- Studying the differences between real-time systems
- Learning real-time system tasks
- Studying approaches to writing software for real-time systems

SHORT DESCRIPTION OF THE COURSE

Currently, real-time systems occupy a special niche of software development. This is due to the narrow focus of the tasks that need to be solved in a real-time system and low-level programming in most cases. At the moment, real-time systems and systems close to real time are distinguished. On the basis of such systems, software models with critical functioning are built, where the tasks that are executed must be performed for a strictly defined period of time. Real-time systems are based on hardware, namely, on the frequency generator of the computing module. In such systems, the runtime slice is determined only by the hardware configuration of the device, while in modern operating systems, the priority of each process can be determined, depending on which the required time slice for the current process will be determined. Real-time systems are critical for the implementation of highly reliable and responsive models such as driving, computer games, and simulations.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:

Understand
- Real-time system concept
- Principles of process logging
- Operating system operating principles

Know
- Methods for creating software for real-time systems

Be able to
- Write software for real-time systems

CAP & ACID Fundamentals

CODE – CSE290
CREDIT – 4
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master major problems constructing distributed and high-performance storage systems. The abbreviation CAP (Consistency Availability Partition Tollerance) is widely used in the construction of architectural solutions for data storage of various levels, from the simplest relational and non-relational storage, to complex distributed systems with partial and full support for the transactional model. ACID —Adomicity, Consistency, Integrity, and Durability — are commonly referred to as relational data stores, so this course focuses on this model primarily using such databases. At the same time, the mechanisms of organizing such a model based on other data storage systems are revealed.

Objectives:

- Learning the Fundamentals of Data Storage
- Examining Data Access Performance
- Studying Blocking Processes and DeadLock State and Fighting Mechanisms
- Exploring Asynchronous Data Access

SHORT DESCRIPTION OF THE COURSE

The course is based on the study of the theoretical foundations of building relational and non-relational data warehouses, transactional models of data isolation and problems of consistency of computational processes. Various storage paradigms are considered in relation to various tasks. The questions of performance and construction of distributed storage architectures based on existing software solutions are raised.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:
Understand

- Types of data stores
- Problems that are solved when building data warehouses
- Data isolation levels in a transactional access model
- Data distribution mechanisms

Know

- Various data stores - relational, non-relational
- fundamental differences between them

Be able to

- Use various data warehouses for building information systems and software products

Big Data Storage Systems & Computations

CODE – CSE306
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of the discipline is to master the principles and acquire practical skills in the organization and technologies of storage, transformation and analytical processing of big data.

Course Objectives - development of research skills on the use of tools for working with big data in information systems for solving practical problems.

SHORT DESCRIPTION OF THE COURSE

The discipline examines the theoretical and practical aspects of using big data technologies in information systems. The lecture course examines trends in the development of infrastructure solutions for processing and storing big data.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Should know:

- basic principles of using big data in enterprise architecture;
- basic methods of analytical processing of big data;

Should be able to:

- to use MapReduce technologies and programs built on the basis of software when working with big data.

Microservices & Cloud Computing

CODE – CSE285
CREDIT – 5
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the models for building scalable systems based on microservice technologies.

Objectives:

- Exploring the concept of microservices
- Exploring the concept of containerization and orchestration
- Exploring the Actor Model

SHORT DESCRIPTION OF THE COURSE

The course is built on modern requirements and trends in the construction of loosely coupled scalable information systems. The microservice model regulates the approach of splitting complex solutions, classically built as a monolithic software module into loosely coupled elements that interact with each other through asynchronous messages. That allows you to develop each of the modules independently and focus on the point performance of the system, if necessary. Such systems are distinguished by a high degree of fault tolerance, since each component is as autonomous as possible. Such approaches require a revision of classical solutions towards the implementation of the integrity model by alternative approaches, since in most cases there is no direct connection between objects of different modules.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:
Understand

- What is microservice and context boundaries
- What is container image and container

Know

- Application containerization platforms
- Model Actor

Be able to

- Use microservice architecture for constructing scalable information systems

High Load Distributed Computing

CODE – CSE291
CREDIT – 4
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to master the models for building high-load systems.

Objectives:

- Analysis of tasks where models of high-load systems are used
- Principles of operation of high-load systems and limitations
- Analysis of software products designed to solve the problems of building high-load systems

SHORT DESCRIPTION OF THE COURSE

The course is built on the basis of modern problems of building scalable systems. The main task is to get out of the systems of constraints imposed by hardware, by optimally distributing the load on each of the links of computers. Thus, defining the architecture that best meets the requirements for the number of requests processing by end systems. Building high-load systems is not a trivial task, which led to the emergence of a large number of software products, as well as forced large companies to expand the product line and functionality of existing ones. In many tasks of building high-load systems, a combination of approaches and software products are used to maximize the efficiency of the system.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:

- Know the nature of the problem with high load systems
- Class of tasks for high-load systems
- Models for building high-load systems
- Software products for building high-load systems

Know

- Software for building high-load systems

Be able to

- Apply models and techniques for building high-load systems

Applied Information Theory

CODE – CSE225
CREDIT – 4
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of the course is to master the fundamental concepts of information theory.

The main objectives of the course:

- Expand the concepts of entropy and information
- Teach to apply methods of quantitative assessment of information
- To reveal the theoretical and practical aspects of optimal (efficient) coding
- To reveal the theoretical and practical aspects of noise immunity coding.
- Show models of signals, data transmission systems, modulation and demodulation, signal sampling.
- To instill the skills of applying the theory of error-correcting coding in data processing systems.

SHORT DESCRIPTION OF THE COURSE

The course focuses on information theory, which is the theoretical basis of information and communication technologies. Information theory explains key aspects of information communication and data processing. The course covers the concepts of entropy, information, optimal coding methods, noise immunity coding methods, and signal models. The course provides some techniques for prototyping signal and data processing software based on linear algebra and information theory.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:
Understand

- what is entropy and information,
- what are effective coding methods and anti-noise methods coding
- mathematical signal models
- when and why specific signal processing techniques should be used and data.

Know

- Basic concepts of data transmission, methods and algorithms for efficient coding, methods of error-correcting coding, signal models, applications of information theory.

Be able to

- develop software for data processing information based on theory
- apply information theory methods to solve practical problems (error-correcting coding, cryptography, data processing)

Machine Learning & Deep Learning

CODE – CSE309
CREDIT – 4
PRE-REQISIT -

PURPOSE AND OBJECTIVES OF THE COURSE

The aim of the course is to master the basic theory and practice of machine learning methods based on widely used open access libraries. To teach how to apply machine learning models in practical problems of software development.

The main objectives of the course:

- Consider the main machine learning models and the tasks they solve
- Get an understanding and experience of neural networks
- Consider modern methods of data classification and clustering
- Exploring current research areas for Deep Learning Models

SHORT DESCRIPTION OF THE COURSE

The course focuses on deep learning models. As an area within machine learning, deep learning models illustrate quantitative-qualitative transition. New models and their properties require a separate study and practice of setting metaparameters of such models.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

Upon completion of the course, students will:

Understand
- Features of deep learning models
- Current Research Areas in AI

Know
- Challenges and Applications of Deep Learning Models

Be able to
- Use machine learning models

The educational program of the scientific and pedagogical magistracy includes two types of practices:
- pedagogical;
- research.

Pedagogical practice is carried out with the aim of developing practical skills and teaching methods.
Pedagogical practice can be carried out during the period of theoretical training without interrupting the educational process.
The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data.

Research work of a master student
Research work in the scientific and pedagogical magistracy should:
- correspond to the main problematics of the specialty in which the master's thesis is being defended;
- be relevant, contain scientific novelty and practical significance;
- be based on modern theoretical, methodological and technological achievements of science and practice;
- carried out using modern methods of scientific research;
- contain research (methodological, practical) sections on the main protected provisions;
- be based on advanced international experience in the relevant field of knowledge.
- performed using advanced information technologies;
- contain experimental and research (methodological, practical) sections on the main protected provisions.

Registration and defense of a master's thesis

The purpose of the master's thesis is:
demonstration of the level of scientific / research qualifications of a master student, the ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.

SHORT DESCRIPTION

A master's thesis is a final qualifying scientific work, which is a generalization of the results of an independent study by a master student of one of the urgent problems of a specific specialty of the corresponding branch of science, which has internal unity and reflects the course and results of the development of the chosen topic. Master's thesis - the outcome research / experimental- research work of a master student, carried out during the entire period of study of a master student.

The defense of a master's thesis is the final stage of the master's preparation. A master's thesis must meet the following requirements:
- the work should conduct research or solve urgent problems in the field of software development;
- the work should be based on the definition of important scientific problems and their solution; - decisions must be scientifically grounded and reliable, have internal unity;
- the thesis should be written individually;

Content