

- NSC “Kazakh National Research Technical University named after K. I. Satpayev”  
Institute of information and telecommunication technologies  
Department «Electronics, telecommunications and space technologies»

**Work curriculum  
CURRICULUMPROGRAM**

**«TELECOMMUNICATION»  
Master (master of engineering and technology)**

First edition  
In accordance with the SES of higher education 2018

**Almaty 2020**

Разработано:	Рассмотрено: заседание УС Института	Утверждено: УМС КазННТУ	Страница 1 из 23
--------------	----------------------------------------	-------------------------	------------------

**The program was created and signed by:**

**From KazNTU named after K. Satpayev:**

1. Head of the Department of electronics, telecommunications and space technology (ETST).....I.Syrgabayev
2. Institute of industrial automation and digitalization named after A. Burkitbayev (IIAD).....B.O.Omarbekov, PhD
3. Chairman of the educational and methodological group of the Department.....A.Khabay, PhD

From employers-Director Of the Institute of space engineering and technology, doctor of technical Sciences .....D.Sh.Akhmedov

Approved at the meeting of the Educational and methodological Council Of the Kazakh national research technical University named after K. I. Satpayev. Protocol №4 from 14.01.2020.

Qualification:

Level 7 of the National qualifications framework (Master)

6M071900-Telecommunications

Professional competence: telecommunications, information and communication technologies, intelligent technologies

### PASPORT OF THE EDUCATIONAL PROGRAMM

Разработано:	Рассмотрено: заседание УС Института	Утверждено: УМС КазНТУ	Страница 2 из 30
--------------	----------------------------------------	------------------------	------------------

**Short description of the program:**

Professional activities of graduates of the program cover the field of telecommunications, electronics, artificial intelligence and radio engineering.

The purpose of the educational program "Telecommunications" is to prepare highly qualified undergraduates based on the integration of education and science of an effective system of training of engineers of the new formation, able to solve the problems of improving society, science and development of new technologies in engineering telecommunications and intelligent info communication systems.

To this end, the student takes a course of theoretical training and exercises considerable relevance and practical significance. The results of the study are issued in the form of a master's thesis, the protection of which takes place in the prescribed manner.

In case of successful completion of the full course of master's degree, the graduate is awarded the academic degree "master of engineering and technology" in the field of engineering telecommunications and intellectual infocommunication.

The educational program of the master's degree "Telecommunications" differs from the existing educational program in the specialty 6M071900 – "radio engineering, electronics and telecommunications" by a complete update of the internal content of the disciplines. The master's program provides for further deepening of competencies acquired in the bachelor's degree and specialization in areas.

The objectives of the educational program is:

- study of the cycle of General education disciplines to provide social and humanitarian education based on the laws of social and economic development of society, history, state language, Russian and foreign languages, modern information technologies;
- Study of the cycle of basic disciplines to obtain natural science, General technical and economic knowledge as the Foundation of professional education;
- study of the cycle of core disciplines for the formation of theoretical knowledge, practical skills and abilities to use for process control in systems of engineering telecommunications and infocommunication systems.
- acquisition of skills and abilities to perform technical calculations and substantiation of design decisions using modern computer technologies and intelligent programs.
- studying of disciplines forming knowledge, skills and abilities of planning and the organization of carrying out theoretical and laboratory researches.
- familiarization with technical processes, systems of organization, planning and management of production during the period of various practices.

Types of labor activity of graduates of the educational program are enterprises, complexes, institutions, educational organizations and other objects, which operate technological systems, technical means, providing any transmission, radiation and reception of signs, signals, written text, images, sounds, wire, radio, optical, as well as the transformation of information by electronic means or infocommunication communication systems:

The objects of professional activity of the educational program is the field of science and technology, which includes a set of technologies, means, methods and methods of human activity aimed at creating conditions for the exchange of information at a distance, the transformation of information using electronic and radio means using modern methods and technology.

## PASSPORT OF THE EDUCATIONAL PROGRAM

### 1 Scope and content of the program

The volume of mastered academic credits determines the term of study in the master's degree. When you master the set amount of academic credits and achieve the expected learning outcomes for a master's degree, the master's educational program considered fully mastered. There are 60 academic credits with a term of study of 1 year in the profile magistracy.

Planning the content of education, the method of organization and conduct of the educational process is carried out by the University and the scientific organization independently on the basis of credit technology of training.

The master's degree in the profile direction implements educational programs of postgraduate education for the preparation of managerial personnel with in-depth professional training.

The content of the educational program of the magistracy consists of:

- 1) Theoretical training, including the study of cycles of basic and core disciplines;
- 2) Practical training of undergraduates: various types of practices, scientific or professional internships;
- 3) Experimental research work, including the implementation of the master's project – for the profile of the master's degree;
- 4) Final certification.

The content of the educational program (OP) "Telecommunications" is implemented in accordance with the credit technology of education and is carried out in the state, Russian languages.

### 1 Objectives of the educational program:

The objectives of the educational program is:

- study of the cycle of General education disciplines to provide social and humanitarian education based on the laws of social and economic development of society, history, state language, Russian and foreign languages, modern information technologies;
- Study of the cycle of basic disciplines to obtain natural science, General technical and economic knowledge as the Foundation of professional education.
- Study of a cycle of profile disciplines for formation of theoretical knowledge, practical skills and abilities in use for management and development of processes in systems of communication, electronics and radio engineering.
- Acquisition of skills and abilities to perform technological calculations and substantiation of design decisions using modern computer technologies and intelligent programs.
- studying of disciplines forming knowledge, skills and abilities of planning and the

organization of carrying out theoretical and laboratory researches.

- Familiarization with technological processes, systems of organization, planning and management of production during the period of various practices.

## **2 Requirements for applicants**

The previous level of education of applicants is 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 admission of citizens to the magistracy is established in accordance with the "Standard rules of admission to education 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 payment for training at the expense of citizens' own funds and other sources. Citizens of the Republic of Kazakhstan the state provides the right to receive on a competitive basis in accordance with the state educational order free postgraduate education, if they receive education at this level for the first time.

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

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

## **3 Requirements for completion of studies and obtaining a diploma**

**Degree/qualifications awarded:** The graduate of this educational program is awarded the academic degree "master of engineering and technology" in engineering telecommunications and intelligent info communication systems.

A graduate who has mastered the master's program must have the following General professional competencies:

- The ability to independently acquire, comprehend, structure and use in professional activities new knowledge and skills, to develop their innovative abilities;
- Ability independently formulate research goals, establish a sequence of professional tasks;
- Ability to apply in practice knowledge of fundamental and applied sections of disciplines that determine the direction (profile) of the master's program;

- Ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems;
- The ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- Possession of skills of drawing up and registration of scientific and technical documentation, scientific reports, reviews, reports and articles;
- Willingness to lead the team in the field of their professional activities, tolerant of social, ethnic, religious and cultural differences;
- Readiness to communicate orally and in writing in a foreign language to solve the problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activities on which the master's program is oriented:

- *production activity:*
  - the ability to independently carry out production, field or abort and interpretative work in solving practical problems;
  - ability to professional operation of modern field and laboratory equipment and devices in the field of master's program;
  - ability to use modern methods of processing and interpretation of complex information to solve production problems;
- *project activity:*
  - ability to independently prepare and submit projects of research and production works;
  - willingness to design a comprehensive research and scientific-production work in solving professional problems;
- *organizational and managerial activity:*
  - readiness to use practical skills of organization and management of research and scientific-production works in solving professional problems;
  - readiness for practical use of normative documents in planning and organization of scientific and production works;

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

## 4 Working curriculum of the educational program

### 4.1. Term of study 1 year

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN  
 Non-profit Joint Stock Company "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after S. SATPAEV"

Satbayev University

Approved by:  
 Rector of Non-profit Joint Stock Company "KazNRTU named after S. Satpaev"  
  
 D. K. Nauryz  
 2020 y.

**WORKING CURRICULUM** of the educational program for master's level for the 1st academic year

Education program "ITMO - Informatics and communication technologies"  
 Group of Educational Programs "ITMO - Communications and communication technologies"

Academic degree: **Magister**  
 Term of study: **1 year**

Year of study	Code	Name of course	Component	Academic credits	Incl. lab/practicum	Prerequisites	Code	Name of course	Component	Academic credits	Incl. lab/practicum	Prerequisites
1	1 semester						2 semester					
	INF202	Foreign language (professional)	OO IC	4	D(0)/0		AAP207	Master's student experimental research work, including internship and master's project implementation	MSERW	13		
	HMG274	Management	BO IC	6	3(0)/3		AAP246	Work placement	PE	7		
	HUM204	Management Psychology	BO OC	4	1(0)/3		ECA206	Registration and defense of the master's project (RaDMP)	FA	12		
	ELC220	Heterogeneous networks and services	BO OC	6	2(0)/3	ELC129, ELC148, ELC147						
	ELC280	Technology internet of things	PS OC	6	3(0)/3							
	ELC287	Modern Science Technologies and Applications	PS OC	6	3(0)/3	ELC110, ELC195, ELC190						
	ELC204	Multimedia technology in telecommunication systems	PS OC	6	3(0)/3	ELC144, ELC181						
In total:				28			In total:				32	
In total:				28			In total:				78	

Number of credits for the whole period of study	
Cycle of disciplines	Credits
The cycle of general education	0
A cycle of basic disciplines ( BO IC, BO OC)	20
A cycle of principal subjects (PS IC, PS OC)	28
All on the theoretical classes:	45
MSERW	13
Registration and defense of the master's project (RaDMP)	12
In total:	78

Decision of the Academic Board of Satbayev University. Protocol No. 3 of " 15.09.2020

Decision of the Academic Board of the Institute. Protocol No. 5 of " 03.11.13

Vice-Rector for Research and Academic Affairs:  D.K. Nauryz  
 Chair of the APC:  K.B. Talgo  
 Director of the Institute:  O. M. Suman  
 Head of the Department:  Suman

zip ^



**MODULAR EDUCATIONAL PROGRAM**

Specialty: 7M06203 Telecommunications

Form of study: *daytime*

Duration of study: 1 y..

Academic degree: Master of Engineering and Technology

Cycle of discipline	discipline code	Name of disciplines	Semester	Number of credits	lec	lab	prac	IWS	Form of control ex	Department
<b>Profile training module</b>										
<b>Basic disciplines (DB) (20-credits)</b>										
<b>University component (UC)</b>										
BD 1.2.1	LNG209	Foreign language (professional)	1	6	0	0	3	3	Exam	АЯ
BD 1.2.2	MNG274	Management	1	6	2	0	1	3	Exam	SEPMC
BD 1.2.3	HUM204	Management Psychology	1	4	1	0	1	2	Exam	SEPMC
<b>Optional component (OC)</b>										
BD 1.2.4	ELC223	Heterogeneous networks and services	1	4	1	0	1	2	Exam	ET&ST
BD 1.2.3.1	ELC261	Fundamentals of Software Defined Radio	1	4	1	0	1	2	Exam	ET&ST
<b>Module theoretical processing and design of telecommunication systems</b>										
<b>Major disciplines (MD) (25-credits)</b>										
<b>University component (UK)</b>										
<b>Optional component (OC)</b>										
PD 1.3.1	ELC205	Multiservice networks	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.1.1	ELC206	Broadband wireless networks	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.2	ELC260	Technology Internet of things	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.2.1	ELC254	Wireless Sensory Networks	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.4	ELC262	Modern sensor technologies and applications	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.4.1	ELC263	The current state of intelligent networks and communication systems	1	6	2	0	1	3	Exam	ET&ST
<b>Practice-oriented module (7-credits)</b>										
PD	AAP246	Work placement	2	7					Report	ET&ST
<b>Research module (13-credits)</b>										
MSERW	AAP207	Master's student experimental research work, including internship and master's project implementation	2	13					Report	ET&ST
Разработано:			Рассмотрено: заседание УС Института			Утверждено: УМС КазНУТУ			Страница 9 из 23	

Final certification module (12-credits)									
FA	ECA206	Оформление и защита магистерской диссертации	2	12				Defense of dissertations	ET&ST
Total credits				70					

## 5 Descriptors of the level and scope of knowledge, skills and competencies

The requirements for the level of preparation of the master's degree are determined on the basis of Dublin descriptors of the second level of higher education (master's degree) and reflect the mastered competences expressed in the achieved results of training.

The results of training are formulated at the level of the entire educational program of the master's degree, as well as at the level of individual modules or disciplines.

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

1) demonstrate developing knowledge and understanding in the field of telecommunications engineering and intelligent infocommunication systems, based on advanced knowledge of this field of communication systems, radio engineering and electronics in the development and (or) application of ideas in the context of the study;

2) apply at a professional level their knowledge, understanding and abilities to solve problems in a new environment, in a wider interdisciplinary context;

3) collect and interpret information to form judgments based on social, ethical and scientific considerations;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions to both professionals and non-specialists;

5) training skills necessary for self-continuation of further training in the field of engineering telecommunications and intelligent infocommunication systems.

## 6 Competencies at the end of training

6.1 Requirements to key competences of graduates of *profile magistracy*, should:

1) *have an idea*:

- on the current state of the economic, political, legal, cultural and technological environment of the world business partnership;

- on the organization of strategic enterprise management, innovation management, leadership theories;

- about the main financial and economic problems of functioning of the enterprises.

2) *know*:

- the main drivers of changes in the structure of the economy;

- features and rules of investment cooperation;

- at least one foreign language at the professional level, allowing for research and practical activities.

3) *can*:

- critically analyze existing concepts, theories and approaches to the study of processes and phenomena;

- integrate knowledge gained in different disciplines, use them to solve analytical and management problems in new unfamiliar conditions;

- to carry out microeconomic analysis of economic activity of the enterprise and to use its results in enterprise management;
- to apply in practice new approaches to the organization of marketing and management;
- to make decisions in complex and non-standard situations in the field of organization and management of economic activity of the enterprise (firm);
- to apply in practice the norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations;
- to think creatively and creatively to solve new problems and situations;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- to summarize the results of experimental research and analytical work in the form of a master's thesis, article, report, analytical note, etc.

*4) have the skills:*

- solutions of standard professional tasks;
- professional communication and intercultural communication;
- oratory, correct and logical design of their thoughts in oral and written form;
- expansion and deepening of knowledge necessary for daily professional activity and continuation of education in doctoral studies;
- use of information and computer technologies in the sphere of professional activity.

*5) to be competent:*

- in the field of modern problems of the world economy and participation of national economies in world economic processes;
- in the organization and management of the enterprise;
- in the implementation of industrial relations with various organizations, including public service;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

**B-Basic knowledge and skills**

**B-basic knowledge and skills:**

- B1 – capable of philosophical analysis of social phenomena, personality behavior and other phenomena. Ready to conduct a philosophical assessment of social phenomena;
- B2 – know and put into practice the basics of engineering professional ethics;
- B3 – to be able to analyze actual problems of modern history of Kazakhstan.

**P – Professional competence:**

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

P2 - able to analyze electrical and wiring diagrams of radio, electronics or infocommunication communication systems.

P3 - ready to perform installation, commissioning and operation of electronics, radio and infocommunication systems;

P4 - ready to participate in the development and design of new electronics, radio and infocommunication systems.

P5 - knows the regulatory and technological documentation of communication systems, electronics standards requirements for infocommunication, electronic and radio systems and devices.

P6 - capable of tuning telecommunication, electronic and radio equipment;

P7 - ability to apply independently scientific technical solutions in the field of engineering telecommunications and intelligent Infocommunications.

P8 – provide technical support to users of information and communication systems.

U - Universal, social and ethical competences

U1 – able to use English, Kazakh (Russian) languages as a means of business and professional communication, a source of new knowledge in the field of engineering telecommunications or infocommunication;

U2-know and apply in work and life the basics of applied ethics and ethics of business communication;

U3-know and apply the basic concepts of professional ethics

S – Special and managerial competencies:

S1– independent management and control of the processes of labor and educational activities within the framework of the strategy, policy and goals of the organization, discussion of problems, reasoning of conclusions and competent handling of information;

S2 - be a specialist in experimental research of electronic and radio engineering or infocommunication communication systems;

S3 - be a research associate for research and synthesis of modern radio and electronics systems or infocommunication communication systems;

S4 - to be an engineer for the development and design of electronic, radio or infocommunication communication systems.

6.2 Requirements for experimental research work of a master student in a specialized master's degree:

1) corresponds to the profile of the educational program of the magistracy, on which the master's project is carried out and protected;

2) it is based on modern achievements of science, technology and production and contains specific practical recommendations, independent decisions of management tasks;

3) performed with the use of advanced information technology;

4) contains experimental research (methodological, practical) sections on the main protected provisions.

#### 6.3 Requirements for the organization of practices:

The educational program of the profile magistracy includes industrial practice in the cycle of PD.

Manufacturing practices in a cycle of PD is carried out to consolidate the theoretical knowledge gained in the process of learning, acquisition of practical skills, competences and professional experience on trained graduate scholarship programs, development of best practices.

### **7 Ects diploma Supplement**

The application is developed according to the standards of the European Commission, the Council of Europe and UNESCO / CEPES. This document serves only for academic recognition and is not an official confirmation of the document of education. Without a diploma of higher education is not valid. The purpose of filling out the European application is to provide sufficient data on the holder of the diploma, the qualification obtained, the level of this qualification, the content of the training program, the results, the functional purpose of the qualification, as well as information on the national education system. The European credit transfer and transfer system (ECTS) is used in the application model for which the estimates will be translated.

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

**Project management**

CODE HUM201

CREDIT 2(1/0/2)

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the discipline "Project management" is the development of project management methodology in various fields of activity, education of culture, adequate to modern project management and information technology, creating conditions for the introduction of new information technologies in the field of projects. The course is based on international project management guidelines (Project Management Body of Knowledge).

**BRIEF DESCRIPTION OF THE COURSE**

The content of the discipline is aimed at the study of modern concepts, methods, tools of project management in order to apply them in the further practical activities of the specialist to solve the problems of planning and execution of projects.

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

Can:

- prepare documents of the project initialization stage, such as feasibility study, project Charter, etc.
- develop and analyze documents related to the planning of project activities, apply various methods of decision support;
- promptly monitor the execution of works and track deadlines;
- to select personnel, to resolve contradictions between team members;
- manage risks arising from the implementation of projects.

Knowledge gained during the course of the discipline:

- Modern standards in the area of project management and characteristics;
- PMI approach to project management;
- Planning of investment activity;
- Consideration of project risks;
- Methods to optimize the use of available resources;
- Ways to resolve conflict situations;
- Analysis of actual indicators to determine the time adjustment of the progress of work.

**Skill:**

- project management in accordance with modern requirements of project management-apply in the process of project management software MS Project

**Foreign language (professional)**

**English (academic)**

CODE – LNG201

CREDIT – 3 (0/0/3)

PREREQUISITE – LNG123

---

### **PURPOSE AND OBJECTIVES OF THE COURSE**

Prepare students for the effective study of academic English at the master's level of the University.

### **BRIEF DESCRIPTION OF THE COURSE**

The course combines four core skills and an academic language. Students are encouraged to study independently and acquire knowledge of the course content.

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

The student will be able to listen to the main points in the listening tasks, take notes while listening, extract key information from the text, predict the content of the text, determine the topic, purpose and main idea of the paragraph, analyze the structure of the paragraph, systematize the information logically, plan and write essays, develop critical thinking skills and comment, participate in the discussion.



**Current state of engineering telecommunications and intelligent systems**

CODE – ELC

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC179 ,ELC128, ELC120

---

**PURPOSE AND OBJECTIVES OF THE COURSE**

is the training of qualified professionals with knowledge and skills in the application of knowledge engineering and Neuroinformatics to solve problems of communication systems.

**BRIEF DESCRIPTION OF THE COURSE**

The course allows you to develop an adequate understanding of the advanced scientific achievements of the last decade. Discipline "Current state of telecommunications engineering and intelligent systems" studies the structure and principles of intelligent telecommunication systems also knowledge engineering, is the study of intellectualization systems engineering telecommunications decision support systems.

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

after studying this discipline the student must:

- know the basic concepts of knowledge engineering
- know the basics of building expert systems, intelligent telecommunication systems and decision support systems
- know the technology of adaptation of intelligent telecommunication communication systems
- able to work with information from various sources to use the appropriate mathematical apparatus and tools for processing, analysis and systematization of information on the topic of research

**Noise-resistant digital information transmission systems**

CODE – ELC249

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

---

**PURPOSE AND OBJECTIVES OF THE COURSE**

Studying the discipline "noise-Resistant systems of digital information transmission" to determine the latest scientific achievements in technology and devices to improve the noise immunity of transmitted messages.

**BRIEF DESCRIPTION OF THE COURSE**

key processes pre-processing of digital information; interference and their effect on a digital signal methods to improve the noise immunity of digital communication, the classification of parameters noise immunity, the model channels noise-immune information transmission, providing noise-immune modulation, the classical methods of creation and implementation of encoders and decoders for error-correcting codes modern methods and device coding.

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

know:

- methods of classical coding and decoding of noise-resistant codes;
- estimation of boundaries of parameters of noise-resistant codes.

Can:

- to illustrate with appropriate examples of construction of functional schemes of encoders and decoders of classical noise-resistant codes;
- to build the functional diagram of the encoders of modern error-correcting codes.

Own:

- to improve noise-resistant coding in digital communication systems.

**Methods of modeling and optimization in information and communication systems and networks**

CODE – ELC220

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

---

**PURPOSE AND OBJECTIVES OF THE COURSE**

To consider the basic concepts and definitions of modeling theory, including the model, the system. The classification of models and the main stages of modeling will also be considered.

*Discipline objectives*

The main task of the theory of modeling is to equip researchers with the technology of creating such models that accurately and fully capture the properties of the originals, easier or faster amenable to research and allow the transfer of its results to the originals.

**BRIEF DESCRIPTION OF THE COURSE**

Object models are divided into two large classes: material (physical) and abstract (mathematical). Among physical models, analog models are the most common. With the development of mathematics, mathematical models were widely used. In essence, all mathematics is designed for the compilation and study of models of objects or processes.

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

*As a result of studying the discipline should know:*

- to know the formalized description of structure and process of functioning of system for unambiguity of their understanding;
- try to present the process of functioning in a form that allows analytical study of the system.

*As a result of studying the discipline should be able to:*

- evaluate the throughput of the network and its components;
- identify "bottlenecks" in the structure of the computer system;
- compare different variants of the organization of the computer system;
- to carry out the perspective forecast of development of computer system;
- predict future network bandwidth requirements using forecast data;
- estimate the required number and performance of servers in the network;
- to compare the various options of modernization of the computer system;

**Broadband wireless network**

CODE – ELC

Разработано:	Рассмотрено: заседание УС Института	Утверждено: УМС КазННТУ	Страница 19 из 23
--------------	----------------------------------------	-------------------------	-------------------

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

---

**PURPOSE AND OBJECTIVES OF THE COURSE**

the purpose of the discipline is the study and practical development of the basics of building and using wireless networks and systems based on them.

**BRIEF DESCRIPTION OF THE COURSE**

classification and characteristics of wireless networks. Access methods in local Wi-Fi wireless networks. Time, frequency, code, spatial methods of access separation in IEEE 802.11 networks. MAC-level of the IEEE 802.11 standard. Organization of physical and channel levels. The spread spectrum technology and methods of modulation of the radio signal. The spread spectrum technology DSSS. Methods of generating information symbols. Modulation BPSK, QPSK. Ways to expand the spectrum of signals. Barker Code. Ways to convert data into a modulation symbol. Modulation methods OBPSK, OQPSK, DBPSK, DQPSK. QAM modulation, data representation on a signal constellation. CCK is a method of encoding and protecting information. Walsh codes and Hadamard matrix. Orthogonal codes. PBCC is a method of encoding and protecting information. OFDM modulation based on Fourier transforms. Forward and reverse Fourier transform for transmitting / receiving information symbols. Ultra-wideband pulse networks. Method of generation and transmission / reception of information symbols based on broadband pulse coding. Ultra-fast wireless networks. 802.11 Wi-Fi networks.xx. Architecture, protocols, characteristics of Wi-Fi networks of 802.11 b, s, xxx standards.

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

– to know the architecture, specifications, methods of construction and application of wireless networks standards, IEEE 802.11 b, 802.11 a, 802.11 g, 802.16; access methods in wireless networks; General methods of generation of information technologies; spread spectrum; coding methods, modulation, conversion information.

- to be able to use methods of construction and application of wireless networks for creation of local networks of Wi-Fi; to use specifications of the IEEE 802.16 WiMAX broadband standard at deployment and operation of city and regional systems.

Master standard terminology and methods for designing and modeling broadband wireless networks for commercial and General purpose applications.

**Experimental research work of the undergraduate**

CODE – AAP227

CREDIT –8

Experimental research work of the master's degree should:

- correspond to the main problems of the specialty in which the master's thesis is defended;
- to be actual, to contain scientific novelty and practical significance;
- based on modern theoretical, methodological and technological achievements of science and practice;
- be carried out using modern methods of scientific research;
- contain research (methodological, practical) sections on the main protected provisions;
- based on international best practices in the relevant field of knowledge.
- be carried out with the use of advanced information technologies;
- contain experimental research (methodological, practical) sections on the main protected provisions.

**Manufacturing practice**

CODE – AAP

CREDIT –6

The master's practical training is conducted in order to familiarize with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of research, processing and interpretation of experimental data.

**Preparation and defense of master's thesis**

CODE – ECA501

CREDIT –7

**Brief description**

Master's thesis/project graduate qualification scientific work, which is a generalization of the results of independent studies undergraduates one of the pressing problems of a particular specialty relevant branch of science that has internal unity and reflects the progress and results of the development of the chosen topic.

Master's thesis / project-the result of research/experimental research work of the undergraduate, conducted during the entire period of study of the undergraduate.

The defense of the master's thesis is the final stage of master's training. The master's thesis / project must meet the following requirements:

- the work should conduct research or solve current problems in the field of engineering telecommunications and intellectual infocommunication;
- the work should be based on the identification of important scientific problems and their solution;
- decisions should be scientifically grounded and reliable, have internal unity;
- dissertation work / project must be written individually;

## Content

- 1 Scope and content of the program
- 2 Requirements for applicants
- 3 Requirements for completion of studies and obtaining a diploma
- 5 Working curriculum of the educational program
- 5 Descriptors of the level and scope of knowledge, skills and competencies
- 6 Competence at the end of training
- 7 Application to ects diploma