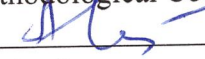



AGREED
by the Chairman of the Educational and
Methodological Council of «ITU» JSC


A.K. Mustafina
«__» _____ 2023 y.

APPROVED
by the Rector
of the «International Information Technology
University» JSC


A.K. Khikmetov
«__» _____ 2023 y.



ACADEMIC PROGRAM

7M06201 - Telecommunication systems and networks

(academic program code and name)

Education area code and classification: 7M06 – Information and communication technologies

Training direction code and classification: 7M062 – Telecommunications

Group of academic programs: M096 – Communications and communications technologies

Level according to ISCED: 7

Level according to NQF: 7

Level according to IQF: 7

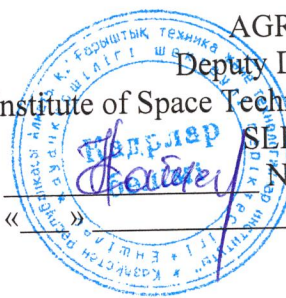
Academic degree awarded: Master's degree in Information and Communication Technologies of the educational program «7M06201 - Telecommunication systems and networks»

Training period: 2 years

Number of credits: 120

AGREED
Deputy Director
Institute of Space Technique and Technology»


SELP
N.M. Saterov
«__» _____ 2023 y.

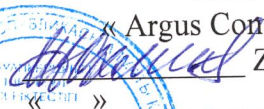


AGREED
President
«ASTEL» JSC


V.Y. Breusov
«__» _____ 2023 y.



AGREED
Director
«Argus Contact» LLP


Zh.K. Akhmetov
«__» _____ 2023 y.



AGREED
President of the Association of Innovative
Companies of the SEZ
«Park of Innovative Technologies»


A.T. Konysbayev
«__» _____ 2023 y.



Almaty, 2023

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List of abbreviations and symbols

CC	Core competency
BM	Base module
HE	Higher education
SCES	State Compulsory Education Standard
EQF	European Qualifications Framework
EFE	European Foundation for Education
KS	Knowledge, skills
NCO	National Classification of Occupations
NQF	National Qualifications Framework
NQS	National Qualifications System
HM	Humanitarian module
GM	General module
EP	Educational program
GPM	General professional module
SQF	Sectoral Qualifications Framework
CE	Comprehensive expertise
PS	Professional standard
PE	Postgraduate education
PC	Professional competency
PM	Professional module
WG	Working group
RK	The Republic of Kazakhstan
LO	Learning outcome
CM	Special module
QMS	Quality Management System
SEM	Socio-economic module
TPE	Technical and professional education
TPEPSE	Technical and professional education and post-secondary education
UNESCO	United Nations Educational, Scientific and Cultural Organization /
UNESCO	a specialized agency of the United Nations Educational, Scientific and Cultural Organization.
Cedefop	European Centre for the Development of Vocational Training
DACUM	from the English. Developing Curriculum
ECVET	European Credit System for vocational education and training
EQAVET	European Quality Assurance in Vocational Education and Training
ENQA	European Association for Quality Assurance in Higher Education / the European Association for Quality Assurance in Higher Education
ESG	Standards and Guidelines for Quality Assurance in the European Higher Education Area
FIBAA	International agency (non-profit foundation) Accreditation and the Higher Education Quality Assessment (Bonn, Germany)
IQM-HE	Internal Quality Management in Higher Education
TACIS	Technical Assistance for the Commonwealth of Independent States
WSI	World Skills International

1. Description of the educational program

The educational program "Telecommunication systems and networks" provides training of highly qualified personnel, focused on the development, implementation, and mobile communications. The program is focused on the area of science and technology, which includes a set of technologies, tools, techniques and methods of human activity aimed at creating conditions for the exchange of information on distance, the conversion information by electronic means, as well as solving research problems, new and development tasks maintain existing telecommunication products. Graduates of the program have a pronounced engineering and scientific thinking, a high level of general cultural development, speak foreign languages.

2. The purpose and objectives of the educational program

The purpose of the educational program - to prepare qualified personnel in the field of radio, telecommunication and electronic systems that are in demand in today's job market.

Objectives of the educational program:

1. in-depth study of modern methods of designing electronic and telecommunications equipment and systems, computer networks and systems;
2. the generation of knowledge on how to develop and design equipment and radio networks and telecommunications, microprocessor-based systems for various applications;
3. develop the skills of the research studies, modeling of objects and processes of radio, telecommunication systems;
4. promote the application of knowledge acquired during the training for the development, modernization and design of electronics and telecommunication systems, to continue their studies in doctoral studies.

3. Requirements for assessing the learning outcomes of the educational program

As the assessment of learning outcomes following forms of examinations used: computer test, written exam (answer sheet), oral examination, project (delivery of the course project), practical (open-ended questions on a computer, the tasks on the computer, including the ACM format), complex (test / written / oral + etc.). In accordance with Table 1, the following is recommended examinations form ratio:

Table 1

№	Form exams	Recommended proportion%
1	Computer testing	20%
2	Writing	10%
3	Oral	5%
4	Project	30%
5	Practical	30%
6	Complex	5%

Disciplines that are brought to the state exam "Reliability of fiber-optic communication lines", "Scientific and technical problems of Radio Engineering, Electronics and Telecommunications" and "The theory and experimental techniques in radio engineering, electronics and telecommunications".

Final certification ends protection of master's thesis.

4. Passport of the educational program

4.1 Overview

№	Field name	Note
1	Code and classification of education	7M06- Information and Communication Technologies
2	Code and classification of training areas	7M062- Telecommunications
3	Group educational programs	M096 - Communication and communication technologies
4	Name of educational program	7M06201-Telecommunication systems and networks
5	Brief description of the educational program	The educational program "Telecommunication systems and networks" prepares highly qualified personnel, focused on the design, implementation and operation of telecom, radio, electronic systems and mobile communication systems. The program is focused on the area of science and technology, which includes a set of technologies, tools, techniques and methods of human activity aimed at creating conditions for the exchange of information on distance, the conversion information by electronic means, as well as solving research problems, new and development tasks maintain existing telecommunication products. Graduates of the program have a pronounced engineering and scientific thinking, a high level of general cultural development, speak foreign languages.
6	The objective of EP	The training of qualified personnel in the field of radio, telecommunication and electronic systems that are in demand in today's job market.
7	Level ISCED	7
8	at the level of NQF	7
9	The level of the SQF	7
10	The list of competences of the educational program:	<p>CC 1: understand the role of science and education in the social life of the current trends in the development of scientific knowledge</p> <p>CC 2: be aware of the current trends in the development of scientific knowledge</p> <p>CC 3: have an idea about the actual methodological and philosophical problems of natural (social, humanitarian, economic) sciences</p> <p>CC 4: have an idea about the professional competence of the teacher of high school</p> <p>CC 5: be aware of the contradictions and the socio-economic consequences of globalization</p> <p>CC 6: know the methodology of scientific knowledge, principles and structure of the scientific activities of the organization</p> <p>CC 7: know the psychology of cognitive activity of students in the learning process, psychological methods and means to improve the efficiency and quality of education</p> <p>CC 8: use this knowledge for original development and application of ideas in the context of scientific research, to critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena</p> <p>CC 9: be fluent in a foreign language at a professional level, allowing to carry out scientific research and to implement the teaching of special disciplines</p> <p>CC 10: creative thinking and creative approach to solving new problems and situations</p>

	<p>CC 11: have the skills of professional communication and cross-cultural communication and oratory, correct and logical registration of the thoughts in oral and written form</p> <p>CC 12: to know the social and ethical values based on public opinion, traditions, customs, social norms and navigate to them in their professional activity</p> <p>CC 13: know the traditions and culture of the peoples of Kazakhstan; be tolerant to the traditions and culture of other peoples of the world</p> <p>CC 14: to be able to work in a team, properly to defend his point of view, to offer new solutions; be able to find compromises, to relate their views to the collective opinion; strive for professional and personal growth</p> <p>CC 15: to be able to self-improvement and professional growth of the individual with diverse humanitarian and scientific knowledge and interests</p>
11	<p>LO1: about explained with this fact and understand the legislative basis of the Republic of Kazakhstan and the countries of the world, and the standardization and certification procedures in the field of electronic and telecommunication systems</p> <p>LO 2: apply practical codes modeling skills and explain the general methodology of programs development</p> <p>LO 3: constitute circuit-channel data transmission system, known method for determining the redundancy message sources and main digital channel characteristics, to be able to count the number of amplifying sections depending on the total losses determine the inter symbol interference</p> <p>LO 4: to demonstrate knowledge quantifying information, error-correcting coding algorithms, cryptographic protection of information, the main functional units of terminal stations DSP multiplexing principles in the formation of higher levels of plesiochronous digital hierarchy</p> <p>LO 5: realize obtained knowledge during maintenance organization and operation of mobile systems, to design a mobile communication network of hierarchical levels, to carry out basic maintenance measurement channels, paths and nodes of the mobile communication apparatus, to calculate parameters networks and telecommunications systems, calculate the parameters for transmitting optical communication cables.</p> <p>LO 6: use knowledge gained in the maintenance and the organization and operation of video surveillance systems, to count the basic geometrical parameters in the construction of video surveillance systems, the system model of the digital television broadcasting, support the choice of frequency band</p> <p>LO 7: design surveillance system in determining the facts that distort the measurement results in determining the depth of field of the scene when it is transmitted to the focus target vidicon, in determining the length of the edge (front) video pulse.</p> <p>LO 8: define problem, formulate hypotheses and objectives of the study; develop a research plan; apply the principles of metrological assurance and methods of instrumental measurements used in the field of information and communication technologies and communication systems, organize and check the technical condition and service life of equipment, use of modern methods and their maintenance and repair, to determine the basic characteristics of modern telecommunication systems, the feasibility and prospects of their use for solving specific problems of the organization of information networks</p> <p>LO 9: simulate redundancy subnet tracts in conditions of selecting the length portions defining the population and the random sample.</p> <p>LO 10: apply theoretical positions disciplines principles of the primary broadcasting network design principles and basic parameters standards analog and digital broadcasting systems, operating principles and methods of engineering calculations of individual units and elements of the apparatus of transmitting broadcasting systems, digital compression standards</p> <p>LO 11: use Data protection technologies in electronic and telecommunication systems</p> <p>LO 12: to apply the cryptographic protection of the information in electronic and telecommunication systems</p>

	LO 13: analyze the safety of electronic and telecommunication systems and conduct monitoring LO 14: analyze the basic technical manual techniques and apparatus provide metrological LO 15: samoostoyatelno versatile and critically analyze contemporary sources, draw conclusions, and to argue them based on the information to make decisions.	
12	Mode of study	Full-time
13	languages courses	Russian
14	The volume of loans	120
15	Awarded academic degree	Master of Engineering and technologies in the educational program 7M06201 «Telecommunication systems and networks»
16	Developer (s) and the authors:	"International University of Information Technology": <ul style="list-style-type: none"> - Head of the department "Radio engineering, electronics and telecommunications", Assistant Professor, Ph.D., Bakhtiyarova Yelena Azhibekovna - Associate professor of the department "Radio engineering, electronics and telecommunications", Ph.D., Aitmagambetov Altai Zufarovich - Senior Lecturer, Master of department "Radio engineering, electronics and telecommunications", Yessenbek Sanida Yassinkyzy

4.2 Correlation matrix of the learning outcomes of educational programs with evolving competencies

	LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO1 0	LO1 1	LO1 2	LO1 3	LO1 4	LO1 5
CC 1	V														
CC 2	V														V
CC 3	V														
CC 4				V											
CC 5	V				V										
CC 6						V									
CC 7															V
CC 8								V	V	V	V	V			
CC 9									V						
CC 10						V	V			V					
CC 11													V		
CC 12	V														
CC 13	V														
CC 14							V							V	

CC 15	V																		V
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4.3 Name of professional standard

№	Name of professional standard	Date of approval of the PS
1	Management of communication and telecommunications networks	24.12.2019
2	Technical support and maintenance of communication networks	24.12.2019
3	Installation of information and communication equipment	24.12.2019
4	Administration, management and diagnostics of computer networks and network infrastructure	24.12.2019
5	Design, installation and commissioning of telecommunication equipment	24.12.2019
6	Design and operation of telecommunication equipment	24.12.2019
7	Network administration	24.12.2019
8	Administration and coordination of communication networks	24.12.2019

4.4. Information about the disciplines

num ber	Name of the discipline	Brief description of the discipline (30-50 words)	Num ber of loans	Molded competenc e (codes)	Prerequisi tes	Postrekv ezity
Cycle basic disciplines The university component						
DB1	History and philosophy of science	The main directions of the problems, theories and methods of philosophy and content of contemporary philosophical discussions on the problems of social development	4	CC1, CC2, CC3, CC12, CC13	not	not
DB2	Foreign language (professional)	Study the functional features of oral and written professionally oriented texts, including scientific, technical, documentation requirements (within the program), adopted in professional communication in Europe and to learn the language	4	CC9	not	not
DB3	Higher School Pedagogy	To study the basic pedagogic categories, methods of pedagogical reality, categorial system Science Education and others.	4	CC4, CC11, CC15	not	Teaching practice
DB4	Psychology of management	Familiarize undergraduates with the resource potential of the human factor in the management of organizations in modern conditions, consider the psychological characteristics of the facilities management of both staff and the organization as a whole, and the subjects of management, which are the managers of different levels, to uncover the psychological mechanisms that ensure the effectiveness of management systems.	4	CC7, CC11	not	not
DB5	Teaching practice	Teaching practice is a form of practice of undergraduates, including the teaching of special disciplines, organization of educational activity of students, scientific	4	CC4, CC11, CC14	Higher School Pedagogy	research practice

		and methodological work on the subject, obtaining skills in the work of the teacher.				
Cycle basic disciplines optionally component						
DB KV1	Reliability of fiber-optic communication lines	In this discipline, graduate study features required for the design and operation of fiber-optic line, payment methods and design principles of modern active and passive fiber optic devices, multiplexing methods for the formation of graduate ready to develop technical documentation and training materials, proposals and activities VOLS effective use.	5	CC6, CC8	not	Modern digital transmission system
	Modern satellite broadband access systems	Studying the features of building modern satellite broadband access systems and their components, classification, features of the choice of orbit and the use of the radio frequency spectrum, international regulation of the orbital-frequency resource for modern non-geostation satellite systems. Study of issues related to frequency assignment, entry into the Master International Frequency Register and obtaining the right to international recognition.	5			
DB KV2	Modern technologies of Information Security in Telecommunication Networks	This discipline deals with the protection of information in telecommunication networks using encryption methods and cryptanalysis. Undergraduates studying various methods and encryption algorithms. Versed in the peculiarities of symmetric and asymmetric algorithms. With cryptanalysis decipher texts. Apply methods for creating electronic signature and a hash function. These cryptographic algorithms are used for storage and transmission of information over telecommunications networks.	5	CC6, CC8	not	master's thesis
	Methods for modeling telecommunication systems and communication networks	The study of basic concepts from the field of modeling theory, classification of models, typical mathematical modeling schemes, as well as the study of planning experiments with models and methods for processing modeling results, mastering the processes of creating models of telecommunication systems and networks, studying the principles of modeling and analyzing the results of the modeling process of various telecommunication systems and networks.	5			
DB KV3	Methods of Digital Signal Processing	Discipline "Methods of digital signal processing" includes the study of signal analysis and analog systems theory, the theoretical basis of the theory of discrete signals and systems, spectral analysis and filtering of digital signals, the digital filter synthesis techniques.	5	CC6, CC8	not	master's thesis
	Modern methods of converting signals	Discipline "Modern Methods signal conversion" exploring methods of transformation signals, the methods and descriptions of discrete digital signals and systems in a time and frequency domain, spectral analysis and filtering of digital	5			

		signals, the basic methods of synthesis and characteristics of digital and adaptive filters.				
Cycle majors						
The university component						
PD1	Scientific and technical problems of Radio Engineering, Electronics and Telecommunications	In this discipline, considered analysis of the state and prospects of development of ground-based and space-based radio systems, the prospects for the development of micro-, nano- and optoelectronics, functional electronics, the problem of electromagnetic compatibility for communication systems and broadcasting, the evolution of networks, current trends in the global telecommunications market, current telecommunications regulation	5	CC2, CC8	not	RES Electromagnetic Compatibility Problems
PD2	Modern radio positioning	The purpose of mastering the discipline "Modern radio positioning" is: to form undergraduates' understanding of the methods of transmitting and receiving radio signals carrying information; the main methods of radio navigation measurements used in radar and radio navigation, radio direction finding - the ability to build generalized structural schemes of radar and radio navigation systems. The study of this discipline considers the measurement of the range and speed of radio waves, methods of measuring distances, measuring angular coordinates, methods of measuring the speed of movement of objects, measuring the orientation angles of aircraft, radar survey of space, determining the location of objects, measuring the angular velocity of objects.	4	CC 6, CC8	not	Theory and technique of scientific experiment
PD3	Modern digital transmission system	This discipline allows undergraduates to study all the basic methods of signal transformation in modern digital transmission systems, the principles of the basic units of modern DSP operating standards of the industry, the basics of building and major components of fiber-optic transmission systems.	4	CC6, CC8	not	master's thesis
PD4	RES Electromagnetic Compatibility Problems	This discipline provides the theoretical basis of a systematic approach to the problem of electromagnetic compatibility, the types of interference, ways to combat interference, technical ways and means of protection from interference, software and technical means EMC arrangements EMC software.	5	CC6, CC8	Scientific and technical problems of Radio Engineering, Electronics and Telecommunications	master's thesis

Cycle majors optionally component						
AP KV1	Modern methods and prospects for using RFS	A study of the major management problems using the radio frequency spectrum and ensuring electromagnetic compatibility of radio electronic means. Undergraduates will study the basic provisions on the management of the use of radio frequency spectrum at the international level, carried out by the administrations of communication through the International Telecommunication Union in accordance with the decisions of the administrative radio and regulations of the Radio Regulations, as well as at the national level, carried out by the State Commission for Radio Frequencies. It will also examine the main provisions of the Radio Regulations and the principles of radio distribution ranges set out approaches to solving important problems of cross-border coordination, presents modern economic methods of management of RFS. Consideration of modern radio control systems, as well as issues of optimal planning of radio networks and organizations radio surveillance service.	5	CC1, CC6, CC8, CC10	Scientific and technical problems of Radio Engineering, Electronics and Telecommunications	not
	Research practice	Research practice is a form of training undergraduates to research and teaching and research activities, which is a kind of practical activity of undergraduates related to the conduct of scientific research within the chosen topic of scientific research work (dissertation research topics).	5	CC6, CC8		
	Research practice	Research practice is a form of training undergraduates to research and teaching and research activities, which is a kind of practical activity of undergraduates related to the conduct of scientific research within the chosen topic of scientific research work (dissertation research topics).	6	CC6, CC8		
Cycle of major disciplines Selectable Component						
	Theory and technique of scientific experiment	Formation of system of representations about the content and methods of scientific research, obtain reliable information, the study of domestic and foreign experience of scientific research and scientific methods of research, the development of a variety of data analysis and processing methods, and learn the planning and organization of the experiment, the study methods of mathematical processing of measurements, the study results methods of performing scientific research and methodologies of theoretical and experimental studies, the analysis of theoretical and experimental research and the formulation of conclusions and recommendations.	5	CC1, CC6, CC8, CC10		

	Methodology and methods of scientific research	<p>The study of the problems of the organization of scientific research, including the typology of methodology, methods and conduct of research work, processing of research results.</p> <p>The study of the basics of methodology and methods of scientific research, including the stages of research, including the choice of research direction, the formulation of scientific and technical problems, conducting theoretical and experimental research, recommendations for the design of the results of scientific work, as well as consideration of the basics of inventive creativity, patent search and the approximate plan of the master's thesis.</p>	5	CC6, CC8		
AP KV2	Embedded systems ICT	<p>The course examines the key principles for building embedded systems, provides an overview of the embedded real-time operating systems, and systems. described architecture processor nodes, and memory hierarchy technology, the structure of the interrupt controllers, devices, and input-output interfaces embedded system. Discusses the key principles of digital electronics, especially digital signals, ways of organizing the interaction of elements, assemblies and systems of digital devices. Investigated algorithms of the basic elements and basic circuits including them, and their associations composed of devices and systems.</p>	5	CC6, CC8	not	master's thesis
	Approaches to the development of standards for mobile networks of new generations	<p>Studying the main global trends in the development of the next generation 6G mobile communications industry, as well as the main stages in the development and implementation of 5G mobile communications technologies, the transition strategy to SDN / NFV and the place of implementation of SDN / NFV in 5G networks, including LTE-Advanced Pro, Internet of things technology (M2M/IoT/IoE), heterogeneous network scenarios, unlicensed spectrum opportunities, operator sharing of network infrastructure, innovative approaches to radio spectrum use.</p>	5			
AP KV3	Artificial intelligence in telecommunication systems	<p>Studying the theoretical foundations of artificial intelligence, the theory of artificial neural networks technologies: mathematical description of an expert system, inference, artificial neural networks, calculation and logic systems, systems with genetic algorithms, multi-agent systems. Also, the study of practical issues of using neural network technologies for solving telecommunication problems. Formation of students' competencies that provide theoretical and practical training in the</p>	5	CC6, CC8	not	not

		field of application of artificial intelligence in telecommunication systems.				
	Network technologies new generations	In the lectures will be given the basic concepts and definitions of network technologies, the issues of standardization of network technologies of new generations of communications in the ITU, 3GPP and the ETSI, principles of construction and architecture of networks of new generations of communication, problems and principles of the radio access network virtualization SDR and core networks SDN				
AP KV4	Space technics and technologies	In this discipline, undergraduates study the theoretical foundations of the use of space technology for communications, television and radio broadcasting, the use of satellite navigation systems, as well as Earth remote sensing systems	4	CC6, CC8	not	master's thesis
	Features of 6G technologies and services	In this discipline, undergraduates will study the features of using the 4G / 5G / 6G network, the spectrum in the terahertz range and optical communication for extremely high data rates, as well as the integration of terrestrial and non-terrestrial networks for ubiquitous access throughout the earth's surface using artificial intelligence (AI).	4	CC6, CC8	not	master's thesis
	The research work of the undergraduate internship including the passage and implementation of the master's thesis	Research work - a way to express themselves masters, as It allows them to show their best qualities of intelligence. This work at the university is carried out under the supervision of the faculty of the university in accordance with the recommended their subjects.	24	CC8	research practice	Master's thesis
	Master's thesis	Master's thesis is the graduation attestation work, in which a master's degree on the basis of their own authoring, scientific research or analysis to solve problems that are serious enough value for a field of study	8	CC2, CC7, CC15	The research work of a student	not

4.4. The list of modules and learning outcomes

Name of the educational program: 7M06201 «Telecommunication systems and networks»

Qualification: Master in Information and Communication Technologies in the educational program "Telecommunication systems and networks"

Module code / module name	learning Outcomes	Criteria for assessment of learning outcomes	Discipline, formative module Code / Name
The basic module			
BMI - Social and Humanities	<p>As a result of studying the discipline, the undergraduate must:</p> <ul style="list-style-type: none"> - have a holistic view of science, its history and place in the system of general knowledge; - be able to navigate the scientific and philosophical concepts of the past and present; - To develop the ability to consider science as a social phenomenon, a value institution and a system of disciplinary field of knowledge. <p>A study of undergraduate discipline must:</p> <ul style="list-style-type: none"> - know: the specifics of stylistic aspects of the evolution of media language, functional styles characteristic of speech and the main genre types of texts - be able to: prepare texts for the media, relevant rules and norms of the literary language, use the language communication skills. <p>As a result of studying the discipline, the undergraduate must:</p> <ul style="list-style-type: none"> - understand the requirements for modern professional education and the personality of a specialist, as presented by the state and society; - Know the theoretical and methodological foundations of higher education pedagogy; the theory of the holistic pedagogical process of the university; - implement a holistic pedagogical process at the university based on modern pedagogical technologies; - carry out diagnostics of the educational process; - be able to carry out innovative pedagogical activities in a university; - organize the process of self-education, self-education and creative self-development; - apply the basic criteria of pedagogical analysis; - implement a pedagogical culture; - be able to prepare and conduct training sessions. 	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Exam</p>	<p>SPS 7001 - History and Philosophy of Science</p> <p>LAN 7001A - Foreign language (professional)</p> <p>SPS 7002- Higher School Pedagogy</p>

	<p>As a result of studying the discipline, the undergraduate should (will):</p> <ul style="list-style-type: none"> - own a system of psychological knowledge, which includes psychological categories and theories of management, management functions and processes, psychological characteristics of objects and subjects of management; - carry out an analysis of the management decision-making process; - evaluate the effectiveness of management styles and staff motivation; - evaluate your own self-management program; - apply technologies and approaches to solving managerial problems; - analyze management effectiveness based on criteria; - be able to implement communicative culture; - be able to prepare and conduct business negotiations; - implement the psychological aspects of teamwork management 	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Exam 	SPS 7003- Psychology of Management
<p>BM2 - Modern methods of transmission and processing</p>	<p>As a result of studying the course graduate should:</p> <ul style="list-style-type: none"> - Know the basic and advanced techniques to ensure protection and security of information in telecommunication systems, basic methods of information protection and their possibilities. - be able to apply in practice today, and basic technologies of information protection in telecommunication systems. - be competent: in modern systems and information protection technology applications available cryptographic systems, methods of cryptanalysis. <p>As a result of studying the discipline, undergraduates should know:</p> <ul style="list-style-type: none"> - features of the construction of modern satellite systems of broadband access and their components; - classification, features of the choice of the orbit and the use of the radio frequency spectrum; - international regulation of the orbital-frequency resource for modern non-geostational satellite systems; - issues related to frequency assignment, entry into the Master International Frequency Register and obtaining the right to international recognition. <p>As a result of studying the course masters will be able to:</p> <ul style="list-style-type: none"> - state and critically analyzing basic position signal converting methods, the basic position of the analog-digital conversion and digital signal processing, and their feasibility; 	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	EEC 7602 -Modern technologies of Information Security in Telecommunication Networks
<p>BM2 - Modern methods of transmission and processing</p>	<p>As a result of studying the discipline, undergraduates should know:</p> <ul style="list-style-type: none"> - features of the construction of modern satellite systems of broadband access and their components; - classification, features of the choice of the orbit and the use of the radio frequency spectrum; - international regulation of the orbital-frequency resource for modern non-geostational satellite systems; - issues related to frequency assignment, entry into the Master International Frequency Register and obtaining the right to international recognition. 	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	EEC 7614 - Modern satellite broadband access systems
	<p>As a result of studying the course masters will be able to:</p> <ul style="list-style-type: none"> - state and critically analyzing basic position signal converting methods, the basic position of the analog-digital conversion and digital signal processing, and their feasibility; 	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	EEC 7619 -Modern methods of converting signals

	<ul style="list-style-type: none"> - to choose and develop efficient algorithms and methods for the conversion of signals set out in the framework of a specific task; - using the experimental equipment set up and operate the device the analog-to-digital conversion; - apply and use the obtained theoretical knowledge of the transformation and processing signals for applications future specialty; - possess modern methods of mathematical algorithms describing digital signal conversion, practical experience implementation methods and devices of the analog-to-digital and digital-analog conversion and digital signal processing; practical skills of experimental work with devices analog-digital and digital-analog conversion. <p>As a result of training course graduate should:</p> <ul style="list-style-type: none"> - understand the basic theoretical methods and means of digital signal processing; - reproduce the physical and mathematical foundations of signal conditioning for digital processing; - select the most effective algorithm for signal processing; - producing a synthesis digital filter, simulation processing; - assess and apply their theoretical knowledge in the field of digital signal processing solutions for the applications of the future specialty. <p>As a result of studying the course graduate should:</p> <ul style="list-style-type: none"> - to design, operate and maintain fiber optic; - be able to carry out technical and economic analysis of the network and to justify decisions taken and implemented at the FOL operation; - apply and implement theoretical knowledge in FOL operation; - to find a compromise between the different requirements for long-term and short-term planning, to make better decisions in the design and operation of fiber-optic; - apply theoretical knowledge practice in the design and operation of fiber-optic line. <p>As a result of studying the course, undergraduates should know:</p> <ul style="list-style-type: none"> - basic concepts from the field of modeling theory; - classification of models, typical mathematical modeling schemes; - issues of planning experiments with models; - methods for processing simulation results; - mastering the processes of creating models of telecommunication systems and networks; 	<p>1. Oral survey</p> <p>2. Testing</p> <p>3. Midterm exam</p> <p>4. Settlement drawings</p> <p>5. Exam</p>	<p>EEC 7603 -Methods of Digital Signal Processing</p>
<p>BM3 - Design of telecommunication systems</p>		<p>1. Oral survey</p> <p>2. Testing</p> <p>3. Midterm exam</p> <p>4. Settlement drawings</p> <p>5. Exam</p>	<p>EEC 7601- Reliability of fiber-optic communication lines</p>
		<p>1. Oral survey</p> <p>2. Testing</p> <p>3. Midterm exam</p> <p>4. Settlement drawings</p> <p>5. Exam</p>	<p>EEC 7615 - Methods for modeling telecommunication systems and communication networks</p>

	<p>- study of the principles of modeling and analysis of the results of the process of modeling various telecommunication systems and networks.</p>		
vocational modules			
<p>PM1 - The current state of RET</p>	<p>As a result of studying the course graduate should: Know: the scientific and technical problems of implementation of communication systems, radio engineering and electronics, the strategic directions of the development of radio and telecommunications systems; Be able to: carry out an analysis of modern telecommunications systems for use in the organization of information networks, as well as analysis of the prospects of micro-, nano- and optoelectronics, functional electronics; Have an idea: on the development of science in the field of telecommunications in the modern conditions of informatization and computerization of society, as well as the use of new network and radio technologies.</p>	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p>	<p>EEC 7604 - Scientific and technical problems of Radio Engineering, Electronics and Telecommunications</p>
	<p>As a result of studying the course graduate should: Know: methods and technologies used in the production of works using radio positioning, types of modern equipment; Be able to: use the equipment and positioning technology for a wide range of geodesy, cartography and navigation, and the results of the processing methods; Have an idea: the development of science in the field of navigation in modern conditions of informatization and computerization of society.</p>	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p>	<p>EEC 7605 - Modern radio positioning</p>
	<p>As a result of studying the course graduate should: - know the theoretical and physical foundations of the theory of electromagnetic compatibility and basic methods for solving problems of electromagnetic compatibility; - to have information about the features of the electromagnetic environment (EME) networks and groupings RES connection, sources of unintentional electromagnetic interference (NEMP), and their characteristics evaluation methods electromagnetic environment (EME); - EMC describe analysis methods in RES groupings as the RES based on mathematical modeling and NEMP propagation environment, and on the basis of an experimental evaluation using CEM different EMC and criteria;</p>	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p>	<p>EEC 7607 - Problems electromagnetic compatibility RES</p>

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	<ul style="list-style-type: none"> - to know the essence of the basic organizational and technical methods to ensure EMC and their possible use in service of radio networks (mobile, microwave and satellite). - to provide high-quality interpretation of the results obtained to practice the regulations in the field of electromagnetic compatibility; - to conduct analysis of EMC in the RES group using mathematical models of radio transmitters, radio receivers and antenna devices; - carry out the calculation for EMC. <p>As a result of studying the course graduate should:</p> <ul style="list-style-type: none"> - explain the principles of scientific research experimental work; - to plan an experiment; - select an object of experimental studies; - to justify the usefulness of the selected experiments; - determine the presentation of the resulting material; - to understand the experimental data. <p>As a result of studying the course, undergraduates should know:</p> <ul style="list-style-type: none"> - basics of methodology and methods of scientific research; - stages of scientific research; - choice of research direction; - formulation of a scientific and technical problem; - carrying out theoretical and experimental research; - recommendations for the presentation of the results of scientific work; - consideration of the basics of inventive creativity, patent search and an approximate master's thesis plan. <p>As a result of studying the course graduate should:</p> <ul style="list-style-type: none"> - to know and classify the main spectrum management processes at national and international levels; - Use regulations of the International Telecommunication Union in the design, implementation and operation of radio systems and networks for different purposes; - own methods of electromagnetic compatibility in the implementation of radio systems and networks of new generations; - use the knowledge gained in the preparation of the position of the Communications Administration of the Republic of Kazakhstan to the ITU World Radiocommunication Conference. 	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p>	<p>EEC 7608 - Theory and technique of scientific experiment</p> <p>EEC 7616 - Methodology and methods of scientific research</p> <p>EEC 7611 - Modern methods and prospects for the use of RFS</p>
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<p>PM2 - Modern telecommunication systems</p>	<p>As a result of studying the course graduate should:</p> <ul style="list-style-type: none"> - to design, operate and maintain the linear path DSP for metallic and optical cables; - Installation and testing of SDH equipment; - the use of terms at the base equipment operation; - to assess the reliability of the information, comparing different sources; - illustrate the educational work with technology funds; - have the teaching methods in university-e; - to analyze the comparison of teaching the concept given the specificity of the specialty. <p>As a result of studying the course graduate should be able to:</p> <ul style="list-style-type: none"> - describe the basic components of an embedded system. - distinguish the difference between Android platforms, Linux and Windows CE. - Identify the main ways to load embedded system. - possess the principles of design and development of embedded systems. - explain the principle debugging software used in embedded systems. - explain the principles of operation of a typical microprocessor and microcontroller; - expand the functions of microprocessor systems, the introduction of these additional peripherals. <p>As a result of studying the course graduate should:</p> <p>have an idea:</p> <ul style="list-style-type: none"> - the architecture of computer networks; - on the problems and prospects of development of network technologies, protocols and systems operators diet. <p>know:</p> <ul style="list-style-type: none"> - the architecture of computer networks, - basic and high-speed technology of local networks, wide area networks; - routing protocols; - Web-based. <p>be able to:</p> <ul style="list-style-type: none"> - to administer networks; - to evaluate and analyze the results. - apply their knowledge in practice. 	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	<p>EEC 7606 - Modern digital transmission system</p>
	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	<p>EEC 7609 - Embedded systems ICT</p>	
	<ol style="list-style-type: none"> 1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam 	<p>EEC 7610 -Network technologies new generations</p>	

	<p>- be competent in matters of contemporary design of wireless devices.</p> <p>As a result of studying the course, undergraduates should know:</p> <ul style="list-style-type: none"> - about the main global trends in the development of the next generation mobile communications industry 6G; - the main stages of development and implementation of 6G mobile communication technologies; - know the transition strategies to SDN / NFV and the place of implementation of SDN / NFV in 5G networks; - including LTE-Advanced Pro; - Internet of things technology (M2M/IoT/IoE), - different scenario of heterogeneous networks; - opportunities to use unlicensed spectrum, - sharing of network infrastructure by operators, - innovative approaches to the use of the radio frequency spectrum. <p>As a result of studying the course, undergraduates should have an idea of:</p> <ul style="list-style-type: none"> - theoretical foundations of artificial intelligence; - theory of technologies of artificial neural networks; - know the mathematical description of the expert system, its logical conclusion, - artificial neural networks, - settlement and logical systems, - systems with genetic algorithms, - multi-agent systems. <p>Also have an idea about the use of neural network technologies for solving telecommunication problems.</p> <p>As a result of studying the course, undergraduates should know:</p> <ul style="list-style-type: none"> - theoretical foundations for the use of space technology for communications; - television and radio broadcasting; - use of satellite navigation systems; - as well as Earth remote sensing systems. <p>As a result of studying the course, undergraduates should know:</p> <ul style="list-style-type: none"> - features of using the 6G network; - spectrum in the terahertz range and optical communication for extremely high data rates; 	<p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p> <p>1. Oral survey 2. Testing 3. Midterm exam 4. Settlement drawings 5. Exam</p>	<p>EEC 7617 - Approaches to the development of standards for mobile networks of new generations</p> <p>EEC 7618 - Artificial intelligence in telecommunication systems</p> <p>EEC 7620 - Space technics and technologies</p> <p>EEC 7621 - Features of 6G technologies and services</p>
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	- as well as the integration of terrestrial and non-terrestrial networks for ubiquitous access on the entire earth's surface using artificial intelligence (AI).		
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5. The curriculum of the educational program

№	Module code	Name of the module	Code of discipline	Name of the discipline	Cycle (GED, BD, MD)	Компонент (OK, KB, BK)	Total credits (ECTS)	Total number of academic hours <i>yaсob</i>	Number of class hours				Number of hours		form of control (RK1, RK2, exam, KP/KH, <i>диф.зачет, зачет, ИИ/ИР</i>)	Prerequisites
									Total class hours	lect ures	lab ora tory	pra ctic al	Total hours SRO	Including PSAS		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	

1 course

1 semester																
№	BM	Module	Code	Discipline	Cycle	Component	Credits	Academic Hours	Total Class Hours	Lectures	Lab	Practical	Total SRO	Incl. PSAS	Control Form	Prerequisites
1	BM 7600	Social and humanitarian module	SPS 7001	The history and philosophy of science	BS	UC	4	45	30	15	15			15	ЭКЗ.	-
2	BM 7600	Social and humanitarian module	SPS 7002	Higher School Pedagogy	BS	UC	4	45	30	30				15	ЭКЗ.	-
3			Elective 1		BS	ES	5	60	45	15	30			15	ЭКЗ.	-
	BM 7602	Design of telecommunications systems	EEC 7601	Reliability of fiber-optic communication lines												
	BM 7602	Design of telecommunications systems	EEC 7614	Modern satellite broadband access systems												
4			Elective 2		BS	ES	5	60	45	15	30			15	ЭКЗ.	-
	BM 7602	Design of telecommunications systems	EEC 7603	Methods of Digital signal processing												

	BM 7602	Design of telecommunications systems	EEC 7619	Modern methods of signal conversion																
5	PM 7604	The current state of the RET	EEC 7604	Scientific and technical problems of radio engineering, electronics and telecommunications	AS	UC	5	60	45	15	30					15	ӘКБ.			-
6	PM 7604	The current state of the RET	EEC 7607	Electromagnetic Compatibility Problems of radio electronic devices	AS	UC	5	60	45	15	30					15	ӘКБ.			-
7	PM 7601	Professional module	RW 7001	Undergraduate research work including internship and master thesis (R & D)	AS	UC	2	60												-
				Total of the semester:			30	900	240	105	135					90				

2 semester



8	BM 7600	Social and humanitarian module	LAN 7001A	Professionally-oriented foreign language	BS	UC	4	45	30		30					15	ӘКБ.			-
9	BM 7600	Social and humanitarian module	SPS 7003	Psychology of management	BS	UC	4	45	30	15	15					15	ӘКБ.			-
10	BM 7601	Professional module	PP 7600	Teaching practice	BS	UC	4	120												BM 7600
11			Elective 3		BS	ES	5	60	45	15	30					15	ӘКБ.			-
	BM 7603	Modern methods of transmission and processing	EEC 7615	Methods for modeling telecommunication systems and communication networks																
	BM 7603	Modern methods of transmission and processing	EEC 7602	Modern technologies of telecommunication networks																
12	PM 7604	The current state of the RET	EEC 7611	Modern methods and prospects for using RFS	AS	UC	5	60	45	15	30					15	ӘКБ.			-
13			Elective 4		AS	ES	5	60	45	15	30					15	ӘКБ.			-
	PM 7604	The current state of the RET	EEC 7616	Methodology and methods of scientific research																
	PM 7604	The current state of the RET	EEC 7608	Theory and technique of a scientific experiment																

14	PM 7601	Professional module	RW 7002	Undergraduate research work including internship and master thesis (R & D)	AS	UC	3	90	195	60	135	75	RW 7001	
Total of the semester:														
3 semester														
15	PM 7604	The current state of the RET	EEC 7605	Modern radio positioning	AS	UC	4	45	30	15	15	15	ЭКЗ.	-
16	PM 7605	Modern telecommunications systems	EEC 7606	Modern digital transmission systems	AS	UC	4	45	30	15	15	15	ЭКЗ.	-
17			Elective 5		AS	ES	5	60	45	15	30	15	ЭКЗ.	-
	PM 7605	Modern telecommunications systems	EEC 7609	Embedded systems in ICT										
	PM 7605	Modern telecommunications systems	EEC 7617	Approaches to the development of standards for mobile networks of new generations										
18			Elective 6		AS	ES	5	60	45	15	30	15	ЭКЗ.	-
	PM 7605	Modern telecommunications systems	EEC 7618	Artificial intelligence in telecommunication systems										
	PM 7605	Modern telecommunications systems	EEC 7610	New Generations Network technologies										
19			Elective 7		AS	ES	4	45	30	15	15	15	ЭКЗ.	-
	PM 7605	Modern telecommunications systems	EEC 7620	Space technics and technologies										
	PM 7605	Modern telecommunications systems	EEC 7621	Features of 6G technologies and services										
20	PM 7601	Professional module	PP 7612	Research practice	AS	UC	5	150					PP 7600	
21	PM 7601	Professional module	RW 7003	Undergraduate research work including internship and master thesis (R & D)	AS	UC	4	90					RW 7002	
Total of the semester:														
75														

4 semester												
22	PM 7601	Professional module	PP 7613	Research practice	AS	UC	6	180				PP 7612
23	PM 7601	Professional module	RW 7008	Undergraduate research work including internship and master thesis (R & D)	AS	UC	16	480				RW 7003
24	PM 7601	Professional module	RW 7004	Магістерлік дисертацыяны Registration and protection of the master's thesis (OIZMD)	AS	UC	8	240				RW 7008
				Total of the semester:			30	900				
				Total of the course:								
				TOTAL:				3600				

6. Reconciliation sheet with developers

Code and name of the academic program 7M06201- «Telecommunication systems and networks»

No.	Academic program Developers (position, academic degree, full name)	Date	Signature	Note
1	Assistant Professor of the Department of Radio Engineering, Electronics and Telecommunications, C.T. Sc., Bakhtiyarova Yelena Azhibekovna			
2	Professor of the Department of Radio Engineering, Electronics and Telecommunications, C.T. Sc., Aitmagambetov Altay Zufarovich			
3	Senior lecturer of the Department of Radio Engineering, Electronics and Telecommunications, Master of RET, Yessenbek Sanida Yassinkyzy		