

**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)**

One set edition  
In accordance with the SES of higher education 2018

**Almaty 2020**

Разработано:	Рассмотрено: заседание УС Института	Утверждено: УМС КазННТУ	Страница 1 из 35
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**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**

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**Short description of the program:**

The professional activities of graduates of the program cover the field of telecommunications, electronics and artificial intelligence.

The goal of the Telecommunication educational program is to train highly qualified undergraduates based on the integration of education and science of an effective system of training scientific, scientific and pedagogical personnel of a new formation, able to solve issues of improving society, science and the development of new technologies in engineering telecommunications and in intelligent information and 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. 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 technical Sciences" 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 – "Telecommunications" by a complete update of the internal content of the disciplines. The bachelor's degree in OP "Telecommunications" provides for the acquisition of competencies in a wider field: telecommunications in order to ensure the adaptation of graduates of the bachelor's degree to the requirements of the labor market. The master's program provides for further deepening of the competencies acquired in the bachelor's degree.

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;
- the 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 of processes in systems of engineering telecommunication and also in infocommunication systems.
- acquisition of skills and abilities to perform technical calculations and substantiation of design decisions using modern computer technologies and intelligent programs.
- study of disciplines forming knowledge, skills and abilities of planning and organization of theoretical and laboratory research.
- 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 info communication communication systems:

The object 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.

## PASSPORT OF THE EDUCATIONAL PROGRAM

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## 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 is considered to be fully mastered. In the scientific and pedagogical magistracy at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the undergraduate.

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 scientific and pedagogical direction implements educational programs of postgraduate education for the preparation of scientific and scientific-pedagogical personnel for Universities and scientific organizations with in-depth scientific-pedagogical and research 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) Research work, including the implementation of the master's thesis – for scientific and pedagogical magistracy;
- 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.

### 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;
- The 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

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of design decisions using modern computer technologies and intelligent programs.

– Study of disciplines forming knowledge, skills and abilities of planning and organization of theoretical and laboratory research.

– 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 higher education institution determines the list of prerequisites independently.

In the absence of the 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 technical Sciences" in engineering telecommunications and intellectual infocommunication.

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 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 that the master's program is focused on:

*research activities:*

- the ability to formulate diagnostic solutions to professional problems by integrating the fundamental branches of science and specialized knowledge obtained by mastering a master's program;
- ability to independently conduct scientific experiments and research in the professional field, to summarize and analyze experimental information, to draw conclusions, to formulate conclusions and recommendations;
- ability to create and research models of studied objects on the basis of in-depth theoretical and practical knowledge in the field of engineering telecommunications and intelligent infocommunication systems;
- *research and production activities:*
- ability to independently carry out production and scientific-production field, laboratory and interpretation 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 activities:*
- 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;
- *scientific and pedagogical activity*;
- ability to conduct seminars, laboratory and practical classes;
  - ability to participate in the management of scientific and educational work of students in the field of engineering telecommunications and intelligent infocommunication systems.

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



## 4 Working curriculum of the educational program

### 4.1. Training period 2 years



MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN  
 The public Joint-Stock Company "NATIONAL RESEARCH TECHNICAL UNIVERSITY "SATBAYEV"  
 Satbayev University

Approved by:  
 \_\_\_\_\_  
 Vice-rector for R&D,  
 \_\_\_\_\_  
 2022 y.

BASIC CURRICULUM of the educational program for the specialty "090201 - Information Systems and Telecommunications" of the educational program "0902 Information and communication technologies" of the Faculty of Educational Programs "0902-Communication and information technologies".

Academic degree: **Master**  
 Type of degree: **Master**

Year of study	Code	Name of course	Language	Academic credits	Prerequisites	Code	Name of course	Language	Academic credits	Prerequisites	
<b>1 semester</b>											
1	EL0201	History and philosophy of science	RU/EN	4	EL0202	Foreign language (arabic/uzbek)	RU/EN	6	90/90		
	EL0202	Higher algebra (optional)	RU/EN	4	EL0203	Management technology	RU/EN	6	120/0		
	EL0203	Fundamentals of Database Defined RDBMS	RU/EN	6	EL0204	Basics of communication and navigation systems	RU/EN	6	20/10	EL0202	
	EL0204	Modern Sensor Technologies and Application	RU/EN	6	EL0205	Emerging telecommunication systems of digital	RU/EN	6	20/10	EL0203	
	Master's student scientific research, including an internship and a master's thesis	MSR		MSR	6	EL0206	Digital Signal Processing Technology	RU/EN	6	10/10	EL0204
						EL0207	Programming the microcontroller	RU/EN	6	20/00	EL0205
						MSR21	Thesis preparation	RU/EN	4	30/00	
				MSR22	Master's student scientific research, including an internship and a master's thesis	MSR	6				
<b>Total</b>				<b>30</b>			<b>MSR21</b>		<b>44</b>		
<b>2 semester</b>											
2	EL0208	History of modeling and optimization in telecommunication systems and networks	RU/EN	6	EL0209	Master's student scientific research, including an internship and a master's thesis	MSR	6			
	EL0209	Wireless Sensor Networks	RU/EN	6	MSR26	Research scientific training	RU	7			
	EL0210	Multiuser MIMO Interference Cancellation	RU/EN	6	EL0211	REGULATED AND SERVICES OF THE INSTITUTE'S (090201)	RU	12			
	EL0211	Multiuser MIMO Interference Cancellation	RU/EN	6	EL0212						
	MSR27	Master's student scientific research, including an internship and a master's thesis	MSR	6							
<b>Total</b>				<b>30</b>			<b>MSR26</b>		<b>20</b>		
							<b>Total</b>		<b>128</b>		

Number of credits for the whole period of study	
Cycle of acquisition	
For study at general education	5
A cycle of basic disciplines (RU/EN, RU/EN)	40
A cycle of courses of specialty (RU/EN, RU/EN)	48
MS or MS (Professional classes)	49
MSR	74
REGULATED AND SERVICES OF THE INSTITUTE'S (090201)	12
<b>Total</b>	<b>128</b>

Decision of the Academic Board of Satbayev University, Protocol No. 1,15 "09" 2022.

Decision of the Academic Board of the Institute: \_\_\_\_\_ Protocol No. 15 "12" 2022

Vice-Rector for Research and Academic Affairs:  E.R. Newmyshayev

Chair of the APC:  E.R. Tolgarevna

Director of the Institute:  Ombayev B.O.

Head of the Department: \_\_\_\_\_ Serzhanov S.

**MODULAR EDUCATIONAL PROGRAM**

Specialty: 7M06201 Telecommunications

Form of study: *daytime*

Duration of study: 2 y..

Academic degree: Master of Engineering Science

Cycle of discipline	discipline code	Name of disciplines	Semester	Academ credit.	lec	lab	prac	IWS	From of control ex	Department
<b>Profile training module</b>										
<b>Basic disciplines (DB) (40-credits)</b>										
<b>University component (VC)</b>										
BD1.2.1	HUM201	History and philosophy of science	1	4	1	0	1	2	Exam	SD
BD 1.2.2	HUM207	Pedagogy of Higher education	1	4	1	0	1	2	Exam	SD
BD1.2.3	LNG202	English language (professional)	2	6	0	0	3	3	Exam	EL
BD 1.2.4	HUM204	Psychology of management	2	4	1	0	1	2	Exam	SEPMC
BD 1.2.5	ELC212	Satellite communication and navigation systems	2	6	2	0	1	3	Exam	ET&ST
<b>Practice-oriented module</b>										
BD	AAP244	Pedagogical practice	2	4					Report	ET&ST
<b>Component of choice (CC)</b>										
BD 1.2.6	ELC261	Fundamentals of Software Defined Radio	1	6	2	0	1	3	Exam	ET&ST
BD1.2.6.1	ELC223	Heterogeneous networks and services	1	6	2	0	1	3	Exam	ET&ST
BD 1.2.7	ELC249	Error-coding transmission systems of digital information	2	6	2	0	1	3	Exam	ET&ST
BD1.2.7.1	ELC252	Разработка и проектирование инженерных телекоммуникационных систем	2	6	2	0	1	3	Exam	ET&ST
<b>Module theoretical processing and design of telecommunication systems</b>										
<b>Major disciplines (MD) (49-credits)</b>										
<b>University component (UK)</b>										
<b>Optional component (OC)</b>										
PD 1.3.1	ELC262	Modern Sensor Technologies and Applications	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.1.1	ELC263	The current state of intelligent networks and communication systems	1	6	2	0	1	3	Exam	ET&ST
PD 1.3.2	ELC214	Digital Signal Processing Technology	2	6	1	1	1	3	Exam	ET&ST
PD 1.3.2.1	ELC215	Telemetry infocommunication systems	2	6	1	1	1	3	Exam	ET&ST
PD 1.3.3	ELC256	Programming the microcontroller	2	6	2	1	0	3	Exam	ET&ST
PD 1.3.3.1	ELC257	Microcontroller devices in REI	2	6	2	1	0	3	Exam	ET&ST
PD 1.3.4	ELC251	Methods of modeling and optimization in infocommunication systems and networks	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.4.1	ELC252	System design of radio electronic means	3	6	2	0	1	3	Exam	ET&ST
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PD 1.3.5	ELC254	Wireless Sensory Networks	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.5.1	ELC256	Technology and architecture of mobile networks	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.6	ELC221	Multichannel RTS information transfer	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.6.1	ELC222	Электромагнитная совместимость радио-электронных средств	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.7	ELC204	Multimedia technology in telecommunication systems	3	6	2	0	1	3	Exam	ET&ST
PD 1.3.7.1	ELC205	Broadband wireless networks	3	6	2	0	1	3	Exam	ET&ST
<b>Practice-oriented module</b>										
PD	AAP236	Research scientific training	4	7					Report	ET&ST
<b>Research module (24-credits)</b>										
RWMS	AAP242	Master's student scientific research, including an internship and a master's thesis	1	6					Report	ET&ST
RWMS	AAP242	Master's student scientific research, including an internship and a master's thesis	2	6					Report	ET&ST
RWMS	AAP242	Master's student scientific research, including an internship and a master's thesis	3	6					Report	ET&ST
RWMS	AAP242	Master's student scientific research, including an internship and a master's thesis	4	6					Report	ET&ST
<b>Final certification module (12-credits)</b>										
FE	ECA205	Registration and defense of the master's thesis	4	12					Defense of dissertations	ET&ST
Total credits				125						

## 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 engineering telecommunications and intelligent infocommunication systems, based on advanced knowledge of this field of engineering telecommunications and intelligent infocommunication systems, in the development and (or) application of ideas in the context of the study;

2) apply your knowledge, understanding and abilities professionally 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) communicate information, ideas, conclusions, problems and solutions clearly and unambiguously to both professionals and non-professionals;

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

## 6 Competencies at the end of training

6.1 Requirements to key competences of graduates of scientific and pedagogical *magistracy*, should:

1) *have an idea*:

- on the role of science and education in public life;
- on current trends in the development of scientific knowledge;
- about actual methodological and philosophical problems of natural (social, humanitarian, economic) Sciences;

- about professional competence of the teacher of the higher school;

- contradictions and socio-economic consequences of globalization processes;

2) *know*:

- methodology of scientific knowledge;

- principles and structure of organization of scientific activity;

- psychology of cognitive activity of students in the learning process;

- psychological methods and means to improve the efficiency and quality of training;

3) *know*:

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- use the acquired knowledge for the original development and application of ideas in the context of scientific research;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge to make judgments and decisions based on incomplete or limited information;
- apply the knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- to think creatively and creatively to solve new problems and situations;
- to be fluent in a foreign language at a professional level, allowing to conduct research and carry out teaching of special disciplines in universities;
- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;

*4) have the skills:*

- research activities, solutions of standard scientific problems;
- implementation of educational and pedagogical activities on credit technology of training;
- methods of teaching professional disciplines;
- use of modern information technologies in the educational process;
- 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.

*5) to be competent:*

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activity in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

**B-Basic knowledge 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 systems of radio engineering, electronics and information and communication communication systems.

P3 – is ready to make installation, adjustment and operation of systems of electronics, radio engineering and infocommunication;

P4 – I am ready to participate in the development and design of new systems of electronics, radio engineering and infocommunication;

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

P6 – able to configure telecommunications, electronic and radio equipment;

P7 – ability to make independently scientific and technical decisions 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 – to 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 – to be an expert on experimental investigations of electronic and radio engineering or information and communication communication systems;

S3 – to be a researcher on the study and synthesis of modern systems of radio engineering and electronics or information and communication communication systems;

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

1) corresponds to the profile of the educational program of the magistracy on which the master's thesis is executed and protected;

2) relevant and contains scientific novelty and practical significance;

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- 3) Based on modern theoretical, methodological and technological achievements of science and practice;
- 4) performed using modern methods of scientific research;
- 5) Contains research (methodical, practical) sections on the main protected provisions;
- 6) Based on international best practices in the relevant field of knowledge.

### 6.3 Requirements for the organization of practices:

The educational program of the scientific and pedagogical magistracy includes two types of practices, which are carried out in parallel with theoretical training or in a separate period:

- 1) Pedagogical in the DB cycle - at the University;
- 2) Research in the cycle of PD-at the place of execution of the thesis.

Pedagogical practice is carried out in order to form practical skills of teaching and learning methods. At the same time, undergraduates are involved in conducting classes in the bachelor's degree at the discretion of the University.

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

## 7 ECTS diploma Supplement

The application is developed by the post-standards of the European Commission, 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 application model, which will be used for the translation of estimates, uses the European system of transfers or credit transfers (ECTS).

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.

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**Foreign language (professional)**

**English (academic)**

CODE – LNG205

CREDIT – 3 (0/0/3)

PREREQUISITE – LNG123

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is to develop students' knowledge of English for their ongoing academic research and to improve their performance in project management.

**BRIEF DESCRIPTION OF THE COURSE**

The course aims to develop vocabulary and grammar for effective communication in the field of project management and to improve the skills of reading, writing, listening and speaking at the "Intermediate" level. Students are expected to acquire and enrich their vocabulary of business English and learn grammatical structures that are often used in the context of management. The course consists of 6 modules. The 3rd module of the course is completed by an intermediate test, and the 6th module is followed by a test at the end of the course. The course ends with a final exam. Undergraduates also need to study independently (MIS). MIS-independent work of undergraduates under the guidance of a teacher.

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

Upon successful completion of the course, students are expected to be able to recognize the main idea and the main message, as well as specific details when listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English on topics related to management; write management texts (reports, letters, emails, minutes of meetings), following the generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, speak about various business situations using the appropriate business vocabulary and grammatical structures - in paired and group discussions, meetings and negotiations..



**History and philosophy of science**

CODE – HUM207

CREDIT – 2 (1/0/1)

PREREQUISITE -

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**COURSE GOALS AND OBJECTIVES** - to reveal the connection between philosophy and science, to highlight the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of philosophy of science, modern problems of development of scientific and technical reality.

**BRIEF DESCRIPTION OF THE COURSE** - subject of philosophy of science, dynamics of science, specificity of science, science and science, antiquity and formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specificity of engineering Sciences, ethics of science, social and moral responsibility of scientists and engineers.

**KNOWLEDGE, SKILLS AT THE END OF THE COURSE** - know and understand the philosophical issues of science, the main historical stages of the development of science, the leading concepts of the philosophy of science, be able to critically evaluate and analyze scientific and philosophical problems, understand the specifics of engineering science, have the skills of analytical thinking and philosophical reflection, be able to substantiate and defend their position, own techniques conducting discussions and dialogue, master the skills of communicative and creative in their professional activities.

**Higher education pedagogy**

КОД – HUM205

КРЕДИТ –2 (1/0/1)

PREREQUISITE – LNG102

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The course aims to study the psychological and pedagogical essence of the educational process of higher school; the formation of ideas about the main trends of development of higher education at the present stage, the consideration of methodical bases of training process in high school, as well as the psychological mechanisms influencing the success of learning, interaction, management subjects of the educational process. Development of psychological and pedagogical thinking of undergraduates.

**BRIEF DESCRIPTION OF THE COURSE**

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

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

At the end of the course the student should know the features of a modern system of higher professional education, organization of educational research, characteristics of subjects of educational process, didactic principles of organization of the learning process in higher education, educational technology, patterns of pedagogical communication, especially educational influences on students and problems of pedagogical activity.

**Psychology of management**

CODE – HUM205

CREDIT –2 (1/0/1)

PREREQUISITE – LNG102

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**PURPOSE AND OBJECTIVES OF THE COURSE**

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

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

**SHORT DESCRIPTION OF THE COURSE**

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

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Upon completion of the course, students will know: the basics of individual and group behavior; basic theories of motivation; basic leadership theories; concepts of communication, management of conflicts and stress in the organization.

will be able to define the different roles of leaders in organizations; look at organizations from the point of view of managers; understand how effective management contributes to an effective organization

## **Fundamentals of Software Defined Radio**

CODE - ELC2612

CREDIT - 3 (2/0/1)

PREREQUISITS:

1. The theory of transmission of Electromagnetic Waves.
  2. Fundamentals of RET.
  3. Digital signal processing theory.
  4. Networking Technologies
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### **THE AIM AND OBJECTIVES OF THE COURSE**

The aim of the course "Fundamentals of Software Defined Radio" is to study the basics of Software Radio Communications.

The objectives of the course are:

- to provide the knowledge of the principles of Digital Signal Processing and Radio Communication processing platforms;
- to provide knowledge about the architecture of the receiver and transmitter;
- the ability to create a software radio communication system.

### **SHORT DESCRIPTION OF THE COURSE**

The course "**Fundamentals of Software defined radio**" provides a wide overview of the standards open source software tools for radio communication implementations and radio communication platforms. The course content covers the architecture of the receiver and transmitter to create a software defined radio communication system. Experimental assignments and course programming examples allow to thoroughly examine the synthesis of communication and sensory functions on the selected platforms.

### **KNOWLEDGE, ABILITY, SKILLS UPON COMPLETION THE COURSE**

Upon completion of the course, undergraduates implement various communication systems and explore communication signals in the real world. And also, undergraduates have the ability to use RTL-SDR keys for wireless communication projects and create an SDR platform.

**Modern Sensor technologies and Applications**

CODE - ELC2622

CREDIT - 3 (2/0/1)

PREREQUISITS: Physics, Microelectronics, Digital communication technology, “Fundamentals of Digital Signal Processing.”

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**THE AIM AND OBJECTIVES OF THE COURSE**

The aim of teaching the course “**Modern Sensor technologies and Applications**” is to introduce the visible range image sensors and discuss basic and advanced Image Processing and Computer Vision algorithms.

The objectives of the course:

- To provide the knowledge about the working principles of recent digital image sensors.
- To explain to master students the main image processing operations.

**SHORT DESCRIPTION OF THE COURSE**

The course “**Modern Sensor technologies and Applications**” covers the basic structure and major application classes of Image Sensors. It discusses high-quality optics that meet the requirements of better image sensors, the basic functions and performance parameters of image sensors, and detailed discussions of both CCD and CMOS image sensors. As well as the course explains how color theory affects the uses of Image Sensors, presents basic image processing and camera control algorithms and examples of advanced image processing algorithms, explores the architecture and required performance of signal processing engines, and explains how to evaluate image quality.

**KNOWLEDGE, ABILITY, SKILLS UPON COMPLETION THE COURSE**

Upon completion of the course, a master student is able to perform basic and advanced image processing algorithms, detect and classify objects in a digital image. **The course gives great opportunities for master students to understand basics of digital image sensors, to analyze the recent machine learning and deep learning algorithms and use Python for Image Processing and Computer vision.**

**Digital signal processing technology**  
CODE – ELC214  
CREDIT – 3 (1/1/1)  
PREREQUISITE – ELC110, ELC149

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

The aim of the discipline is to form clear ideas about the fundamental provisions of the theory of digital signal processing technology.

- teaching the basics of analytical and numerical methods of calculation and analysis of digital converters of measuring signals;
- Development of skills of design of digital measuring converters, processing of experimental results and their analysis.

#### *Discipline objectives*

- creation of optimal conditions for teaching the discipline taking into account the level of training of students in mathematics, physics and electronics.

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

Basic concepts of physical magnitude, measurement and signal conversion. Signal classification: deterministic and random signals, continuous, discrete and quantized signals.

Types of deterministic signals, their parameters. Single pulse, constant signal, harmonic and polyharmonic signals. Decomposition of a periodic signal into a Fourier series. Signal spectrum.

Non-periodic (transient) signals. Fourier transform for transient signals.

Analog system. Pulse and transient characteristics. Gain.

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

Because of studying, the discipline should know and be able to:

- Basic methods of mathematical description of signals and digital measurement transformations;
- The most important properties and characteristics of digital transducers;
- Principles of hardware implementation of digital signal processing systems;
- Methods of calculation of digital transducers.

**Multiservice network**

CODE – ELC247

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC132,ELC179, ELC1328 ,ELC120

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**PURPOSE AND OBJECTIVES OF THE COURSE**

*Purpose of discipline* to study multiservice networks, their structure, technological aspects of construction, services provided, issues of service quality assurance.

*Discipline objectives*

Multiservice telecommunication networks, their structure, technological aspects of construction, services provided, issues of service quality assurance. Methods of load forecasting, calculation of service indicators, calculation of data traffic characteristics.

- Study of the principles of MSS construction;
- Analysis of the main MSS protocols;
- Research of methods of construction of models of networks with unicast and multicast connections;
- Study of exact and approximate methods

Analysis of models of multiservice networks.

**BRIEF DESCRIPTION OF THE COURSE**

Multiservice communication network-a way to implement the concept of NGN.

NGN-the concept of development of communication networks in the direction of creating a universal network infrastructure that would allow you to transfer any kind of information and provide users with any services, regardless of time and location. Multiservice communication network is focused on providing a wide range of services within a single network structure.

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

*Because of studying, the discipline should know:*

- Basics of building multiservice networks (MS);
- Multiservice network architecture; - MS equipment; - MS routing methods;
- Settings of complex switching devices; - creation of networks on modern information transfer protocols.

**Internet of things technology**

CODE – ELC260

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC132

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**PURPOSE AND OBJECTIVES OF THE COURSE** to study scientific and technical problems of introduction of wireless self-organizing networks.

**BRIEF DESCRIPTION OF THE COURSE**

Self-organizing networks, introduction to the concept of the Internet of Things, pervasive sensor networks, wireless self-organizing networks and self-organizing networks for vehicles, as well as an overview of the basic protocols for controlling access to the transmission medium, routing and transport layer. Network with variable topology. Dynamic. Decentralized. Mobile. Nodes that make up the network. This can be personal computers, laptops, smartphones, tablets, smart sensors and other devices.

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

Because of studying the discipline the student should know:

- principles of construction of self-organizing networks, the main protocols of access control to the transmission medium, routing and transport layer used in these networks(UCS-1);

- Bases of construction of self-organizing networks; - architecture of the self-organizing network; - the equipment of self-organizing networks;

- Methods of information gathering in self-organizing networks; - theoretical bases of design of wireless self-organizing systems.

- To be able: - to make normative documentation, to organize maintenance of the telecommunication equipment (OPK-2); skills of carrying out measurements (ONK-1, IK-1, IK-5).

must be able

- To use in cognitive and professional activity basic knowledge in the field of mathematics and natural Sciences (ONK-1);

- To use in social and professional activity skills of work with the computer (IK-1);

- To make scientific and technical reports, reviews, explanatory notes (OPK-2);

- Strategic directions of development of communication systems and communications.



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

CODE– ELC

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

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**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 – ELC207

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

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**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.

Be able to

- 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

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

**Microcontroller programming**

CODE – ELC256

CREDIT – 3 (2/1/0)

PREREQUISITE – ELC171

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**PURPOSE AND OBJECTIVES OF THE COURSE**

preparation of the master student for independent use of microcontrollers for management and regulation of telecommunication systems

**The objectives** of the discipline are:

- types of processor architectures;
- types of modern ways to configure the microcontroller;
- types of communication protocols;
- methods and methods of building microcontroller systems;
- language of configuration of programmable logic circuits at the basic level.
- ability to develop a command system for microcontrollers;
- skills of work with means of debugging and programming of microcontrollers.

**BRIEF DESCRIPTION OF THE COURSE**

Classification of microcontrollers used in telecommunication systems, the structure of the microcontroller, the organization of interrupting the microcontroller, study, external devices of the microcontroller, features of operation and study of the programming environment of microcontroller systems.

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

- be able to classify microcontroller systems;
- be able to use microcontrollers in the design of telecommunication systems.

Know the programming environment for the design and management of communication systems.

**Optical communication system components**

CODE – ELC219

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC131

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**PURPOSE AND OBJECTIVES OF THE COURSE**

teaching students the choice of optical communication system, principles and methods of signal transmission via fiber optic cables, scientific foundations and the current state of the fiber optic communication system. It deepens and develops the training of communication engineers, mastering modern technology of construction and transmission of digital information. Obtaining knowledge skills in the transmission of optical signals via optical cables

**BRIEF DESCRIPTION OF THE COURSE**

The course covers the following main sections of optical systems:

- transmission of light signal by optical fiber.
- application of fiber-optic amplifiers.
- to organize a fiber-optic communication line.
- laying fiber optic.
- installation of optical cables.
- planning of the route and laying of FOCL.

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

In the process of training, doctoral students should have a clear idea of the main directions and prospects for the development of communication systems and technology, know the organization of telecommunications enterprises, the main parameters and requirements of the fiber-optic communication line.

Know: the organization of telecommunications enterprises, the main parameters and requirements of fiber-optic communication line.

To possess: to design fiber-optic communication line.

**Multi-channel RTS information transfer**

CODE – ELC221

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC131

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is to familiarize the students the principles of construction of radio transmitters and forming of signals, principles of radio receivers and radio signal processing, qualitative characteristics of channels and circuits of communication, the principles of modern communication systems. And also, the study of the basics of the theory and methods of construction of the main types of multi-channel RTS, the study of the composition and principles of the RTS.

**BRIEF DESCRIPTION OF THE COURSE**

The course covers the following main sections: Principles of radio communication. Classification of radio wave bands. Elements of the theory of propagation of radio waves. Features of electromagnetic waves propagation. Different range. Features of radio communication system. Radio transmission of continuous messages. Differential entropy of a continuous signal. The bandwidth of the communication channel in the transmission of continuous signals. Characteristics of communication channels and paths.

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

know the methods of electronic modeling;

- achievements of science and technology at home and abroad in the development and production of electronic equipment;  
- methods of analysis and synthesis of communication networks.

Know:

- basic principles of information transmission systems of radar systems, radio navigation systems;  
- basic principles of work;  
- basic relations of the theory of radio engineering systems design;

Own:

- to apply methods of optimal solutions theory in designing Radiosystems of information transfer, radiolocating systems;  
- to collect and analyze scientific and technical information, to summarize domestic and foreign experience in the field of radio engineering;  
- to carry out preparation of scientific researches and technical developments

**Broadband wireless network**

CODE– ELC216

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC110 ,ELC149

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**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. Construction of punctural and convolutional encoders. 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.

**Satellite communication and navigation systems**

CODE – ELC249

CREDIT – 3 (2/0/1)

PREREQUISITE – ELC1702

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**PURPOSE AND OBJECTIVES OF THE COURSE**

to study types of orbits and parameters of satellite systems, architecture and principles of operation of satellite communication systems, navigation satellite systems, features of equipment for satellite communication. Parameters of signals and channels, radio relay communication lines, digital radio communication systems, auxiliary systems. The study of the discipline contributes to the successful preparation for professional development of a specialist.

**BRIEF DESCRIPTION OF THE COURSE**

communication system: the service area, the bandwidth, the parameters of the orbits and number of satellites. Space stations (CS) and ground stations (NS), modulation methods, quality of organized channels. Characteristics of satellite communication stations: operating frequency range equivalent isotropic radiated power (eirm), the number of trunks and their bandwidth, relay method with or without signal processing. Transmission of TV signals in analog form using frequency modulation (FM) and in digital form via satellite channels. Features of construction of satellite navigation systems, coordination of satellite navigation systems "GLONASS" and "NAVSTAR" - GPS.

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

- know the technical concepts of building satellite systems, the main parameters of radio channels and methods for determining these parameters; the main methods of calculating the energy parameters of systems and technical parameters of networks; purpose and functional schemes of information systems, methods of multi-station access and their applications; technical parameters of standards of satellite systems.

- to have an idea about trends in the development of technologies of information satellite systems, about the laws that determine the relationship between the quality indicators of channels, energy parameters of the system, indicators of effective use of frequency bands and power, economic indicators of systems.

**The educational program of scientific and pedagogical magistracy includes two types of practices:**

- pedagogical;  
CODE – AAP316  
CREDIT –6

Pedagogical practice is carried out in order to form practical skills and teaching methods.

Pedagogical practice can be carried out in the period of theoretical training without interruption from the educational process.

- CODE – AAP233  
CREDIT –6

The research practice of the undergraduate 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.

### **Research work of the undergraduate**

- CODE – AAP218,226,234  
CREDIT –15

Research work in the scientific and pedagogical magistracy 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.
- carried out with the use of advanced information technology;
- contain experimental research (methodological, practical) sections on the main protected provisions.



**Master's thesis defense**

CODE – ECA203

CREDIT –7

The purpose of the master's thesis is:

demonstration of the level of scientific/research qualification of the undergraduate, the ability to independently conduct a scientific search, checking the ability to solve specific scientific and practical problems, knowledge of the most common methods and techniques for solving them.

**Brief description**

Master's thesis is a final qualifying scientific work, which is a generalization of the results of independent research by a graduate student of one of the actual problems of a particular specialty of the relevant branch of science, having an internal unity and reflecting the progress and results of the development of the chosen topic.

Master's thesis-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 must meet the following requirements:

- the work should be carried out research or solve current problems in the field of engineering telecommunications and intelligent Infocommunications;
- 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 must be written alone;

## Content

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

