Ministry of Agriculture of the Republic of Kazakhstan

JSC "Kazakh Agrotechnical Research University named after S.Seifullin"

Faculty of «Energy»

Department «Radio engineering, electronics and telecommunication»

I APPROVE
Dean of the Energy Faculty Office
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(Signature) (Full name)
«22» 06 2024y.

6B06201
(Cipher Educational programs)

Telecommunication networks and systems
(Name Educational programs)

CATALOG ELECTIVE DISCIPLINE

2024years
receipts

ASTANA, 2024

Catalog elective disciplines of the OP
developed on basis worker curriculum OP «Telecommunication networks and systems».

Catalog elective disciplines discussed on meeting departments «Radio engineering, electronics and telecommunication»

protocol № 13 from «23» 05 2024 y.

Catalog elective disciplines reviewed on meeting Faculty Council on Academic Quality

protocol № 15 from «21» 06 2024 y.

Head of Department department — signature — Full name, rank, degree

Chairman of the SFAK — signature — Full name, rank, degree

Introduction

Dear student (master's student, doctoral student)!

Before you is the Catalogue of Elective Subjects. This is a systematized annotated list of elective academic subjects. It was developed for the purposes of providing the opportunity for independent, prompt, flexible and comprehensive formation of an individual learning path. This is your assistant in creating your individual curriculum. With the credit technology of education, all academic disciplines are divided into 3 cycles - General Education (GED), Basic (BD) and Profiling (PD). Within each of these cycles, academic disciplines are divided into 2 types - Compulsory Component and Elective Component (elective, i.e., elective academic disciplines). The compulsory component disciplines are established by the State Compulsory Education Standard and are studied by all students of this educational program without exception . Elective academic disciplines are offered to you for study by departments. Your advisor will help you choose elective academic disciplines.

Contents

1. MAIN TERMS AND THEIR DEFINITIONS

An educational program is a single set of basic characteristics of education, including the goals, results and content of training, the organization of the educational process, the methods and techniques of their implementation, and the criteria for assessing the results of training.

The content of the educational program of higher education consists of disciplines of three cycles – general education disciplines (hereinafter – GED), basic disciplines (hereinafter – BD) and specialized disciplines (hereinafter – PD).

The cycle of the educational course includes disciplines of the compulsory component (hereinafter referred to as OC), the university component (hereinafter referred to as VC) and/or the elective component (hereinafter referred to as EC). The BD and PD include disciplines of VC and EC.

The working curriculum (hereinafter referred to as WCP) is an educational document developed by the OVPO independently. based on the educational program and individual educational plans of students;

The Catalogue of Elective Disciplines (CED) is a systematized annotated list of all disciplines of the elective component for the entire period of study, containing their brief description indicating the purpose of study, brief content (main sections) and expected learning outcomes. The CED reflects the prerequisites and postrequisites of each academic discipline. The CED should provide students with the opportunity to choose alternative elective academic disciplines to form individual educational trajectory. Based on the educational program and the KED, students develop individual educational plans with the help of advisors .

Individual educational plan (hereinafter IEP) is a student's educational plan, independently formed by him for each academic year with the help of an advisor based on the educational program and the catalog of elective disciplines;

The mandatory component is a list of academic disciplines and the corresponding minimum volumes of academic credits established by the State Educational Standard and studied by students on a mandatory basis according to the curriculum;

University component (hereinafter referred to as UC) is a list of academic disciplines and corresponding minimum volumes of academic credits determined by the higher professional education institution independently for mastering the educational program;

Elective component – a list of academic disciplines and corresponding minimum amounts of academic credits, proposed by the OVPO independently chosen by students in any academic period, taking into account their prerequisites and postrequisites ;

Elective disciplines – academic disciplines included in the university component and the elective component within the established academic credits and introduced by the Higher Professional Education Department, reflecting the individual preparation of the student, taking into account the specifics of socio-economic development and the needs of a particular region, and established scientific schools.

Prerequisites (Prerequisite) (prerequisite) – disciplines and (or) modules and other types of academic work containing knowledge, abilities, skills and competencies necessary for mastering the studied discipline and (or) modules;

Post-requisites (Postrequisite) (postrequisite) – disciplines and (or) modules and other types of academic work, the study of which requires knowledge, abilities, skills and competencies acquired upon completion of the study of a given discipline and (or) module;

Learning outcomes are the volume of knowledge, skills, and abilities acquired and demonstrated by the student in mastering the educational program, as confirmed by the assessment, and the values and attitudes formed;

Advisor - a teacher who performs the functions academic mentor of a student in the relevant educational field program, providing assistance in choosing a learning path (formation of an individual curriculum) and mastering the educational programs during the training period;

The register of educational programs is the information system "Unified Platform for Higher

Education" (hereinafter referred to as the information system) of the authorized body in the field of science and higher education, which includes a list of educational programs developed by organizations of higher and (or) postgraduate education.

Competencies are the ability to practically use the knowledge, skills and abilities acquired during the learning process in professional activities.

2. STRUCTURE KED

2.1 Catalog elective disciplines, contains next information:

- Cycle disciplines;
- Discipline code ;
- Name disciplines;
- Semester of study (semesters of study of prerequisite and postrequisite disciplines should not coincide with semesters of study of the discipline itself);
- Quantity loans;
- Prerequisites ;
- Post-requisites;
- Brief description of the discipline;
- Expected learning outcomes.

Cycle	Disc code	Name disc	Semeter	Number of credits	Department	Prerequisites	Post-requisites	Brief description of the discipline	Expected learning outcomes
OOD	PP 2113	Business law	3	5	RET	Economic theory, principles of law, principles of anti-corruption culture	Financial, tax, currency and investment rights.	Study of the legal foundations of entrepreneurial activity in the context of the modern development of the market economy of Kazakhstan, the theory and practice of applying the norms of entrepreneurial law in relation to the materials of the practice of resolving economic disputes.	PO11 To develop students' competencies in the field of economics and law, the basics of anti-corruption culture, ecology and life safety, as well as entrepreneurship skills and scientific research methods.
OOD	MNI 2113	Methods of scientific research	3	5	RET	Information and communication technologies	Graduation work	Formulation of a scientific problem based on the discovery of contradictions between the currently available knowledge about the object of research and the knowledge necessary for the practical solution of the problem in demand by society. Selection of a topic and	RO11 To develop students' competencies in the field of economics and law, the basics of anti-corruption culture, ecology and life safety, as well as entrepreneurship skills and scientific research methods.

								scientific justification of its relevance for practical application. Formulation of a hypothesis, development of a scientific research plan. Methods of theoretical, experimental research and presentation of scientific results.	
OOD	EOBZh 2113	Ecology and Fundamentals of Life Safety	3	5		Biology, chemistry as part of the school curriculum	No	The course develops practical skills in identifying hazardous and harmless natural conditions, preventing the causes and conditions for the occurrence of hazardous situations, protecting the population and production facilities from possible consequences of hazardous situations. Features of labor protection for women and youth, supervision and control over compliance with labor protection legislation and responsibility for compliance with labor protection standards.	PO 9 Demonstrate knowledge of modern technologies, standardization requirements, metrological support and life safety in the development and operation of radio engineering devices and information communications systems . RO11 To develop students' competencies in the field of economics and law, the basics of anti-corruption culture, ecology and life safety, as well as entrepreneurship skills and scientific research methods.

OOD	OAK 2113	Fundamentals of Anti-Corruption Culture	3	5		Philosophy, political science and sociology, foundations of law	Financial law, tax law, civil law	The course forms a system of knowledge on combating corruption, and on this basis, developing a civic position in relation to this phenomenon. As a result of mastering the discipline, students will be able to: navigate the legislation; analyze and apply regulatory legal acts in specific situations, follow moral and legal norms; express and substantiate their own point of view on issues of anti-corruption culture	RO11 To develop students' competencies in the field of economics and law, the basics of anti-corruption culture, ecology and life safety, as well as entrepreneurship skills and scientific research methods.
OOD	OEP 2113	Fundamentals of Economics and Law	3	5		Philosophy, history of Kazakhstan, mathematics	Business planning	The discipline promotes knowledge of the subject of economic theory and research methods, the foundations of social production and forms of social economy, the mechanism of functioning of the market system, production, costs and income of the company, national economy. To master knowledge of the foundations of the	RO11 To develop students' competencies in the field of economics and law, the basics of anti-corruption culture, ecology and life safety, as well as entrepreneurship skills and scientific research methods.

								theory of state and law, the foundations of constitutional, administrative, civil, labor, family, criminal law.	
PD	NSS 3312	Control communication systems	5	5	RET	Electromagnetic fields and waves, theory of electrical circuits – 1, theory of electrical circuits -2, fundamentals of telecommunications. Theory of electrical communication.	Technologies of transport communication networks. Design and operation of telecommunication systems and communication networks. Reliability of television and radio electronic equipment. Diploma work and diploma project.	Classification, frequency range and design elements, features of guiding systems in the infocommunication sphere. Theory of guiding systems, application of electrodynamics. Transmission of electromagnetic energy via guiding systems, primary and secondary transmission parameters. Theory of optical communication. Information about optical fiber – guiding system of optical cable, various designs. Basic parameters of optical fiber. Basic parameters of optical cable.	PO3 Have deep knowledge of information and computer technologies, the fundamentals and elemental base of telecommunications used in professional activities. PO5 Be able to carry out calculations for the design of information communications systems and networks , use modern software packages for calculations, modeling and design of electronic devices and information communications systems .
PD	KSS 3312	Cable communication systems	5	5	RET	Electromagnetic fields and waves, theory of electrical circuits -1, theory of electrical	Technologies of transport communication networks. Design and	Classification, frequency range and design features of telecommunication	PO3 Have deep knowledge of information and computer technologies,

						circuits -2, fundamentals of telecommunications, theory of electrical communication.	operation of telecommunication systems and communication networks. Reliability of television and radio electronic equipment	guide systems. Electrodynamics of guide systems. Primary and secondary transmission parameters. Theory of optical communication systems. Optical fibers, design features. Parameters of optical fiber and cable. Electromagnetic products, corrosion of telecommunication cables. Design, installation and operation of CLS telecommunications.	the fundamentals and elemental base of telecommunications used in professional activities. PO5 Be able to carry out calculations for the design of information communications systems and networks , use modern software packages for calculations, modeling and design of electronic devices and information communications systems .
PD	OSMS 3313	Fundamentals of Mobile Communication Systems	6	5	RET	Engineering mathematics, fundamentals of telecommunications, electromagnetic fields and waves, antenna-feeder devices and radio waves, digital signal processing	Design and operation of telecommunication networks, communication networks for IOT	Review and classification of modern mobile radio communication systems. Organizational system of mobile radio communication systems. Composition and structural elements of the cellular	PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices for processing and converting data transmission signals. PO7 Have knowledge of the

								communication system. System of basic studies. Features of radio wave propagation in commercial mobile communications. Functioning of cellular mobile radio communication systems. Radio planning of cellular mobile radio communication systems	basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless systems.
PD	TBS 3310	Wireless communication technologies	6	5	RET	Mathematics 1,2, engineering mathematics , physics, electromagnetic fields and waves , electrical circuit theory 2 , digital communication theory , digital signal processing .	Internet of Things; Satellite and Radio Relay Communication Systems .	Wireless communications classification methods are being replaced by the use of energy sources. Amplitude, frequency, and bi-position phase shift keying. Coherent and non-coherent detection. Multi-position phase and quadrature	PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices for processing and converting data transmission signals. PO7 Have knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio

								modulation. Multiple access. Expansion methods. Features of channel transmission in wireless networks. Models for calculating signal power losses. Concept, components, principles, and systems of a cellular network. Trunking systems. Cordless telephony. IEEE 805.15.X, IEEE 802.15.4 :, 802.11 standards. LPWAN technology.	waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless systems.
PD	NTA 4305	Reliability of television and radio electronic equipment	7	3	RET	Mathematics I, II , physics , engineering mathematics, theory of electrical circuits 1,2 , digital devices and microprocessor technology 1,2.	Design and operation of telecommunication networks, satellite and radio relay lines.	The problem of assessing the reliability of electronic equipment. Basic concepts of reliability of electronic equipment. Reliability of elements of technical systems of electronic equipment. Mathematical hardware tests of reliability of electronic equipment. Concepts of disconnection and restoration of electronic equipment elements. Distribution	PO3 Have deep knowledge of information and computer technologies, the fundamentals and elemental base of telecommunications used in professional activities. PO 9 Demonstrate knowledge of modern technologies, standardization requirements, metrological support and life safety in the development and operation of radio engineering devices and information

								functions of failure-free operation of electronic equipment. Determination of the reliability of a technical system of electronic equipment by the reliability of its elements. Hardware redundancy. Factors determining the reliability of electronic equipment. Reliability of a system with restoration of electronic equipment	communications systems .
PD	OORU 4315	Assessment of fault tolerance of electronic devices	7	3	RET	Mathematics I, II , physics , engineering mathematics, theory of electrical circuits 1,2 , digital devices and microprocessor technology 1,2.	Design and operation of telecommunication networks, satellite and radio relay lines.	The problem of the lack of stability of electronic devices. The main concepts related to the possibility are applied to the definition of fault tolerance of electronic devices. Fault tolerance of an element of technical systems. Types of failures. Failure distribution functions. Concepts of recovery and failure of elements of electronic devices. Statistical methods evaluate the fault tolerance of	PO3 Have deep knowledge of information and computer technologies, the fundamentals and elemental base of telecommunications used in professional activities. PO 9 Demonstrate knowledge of modern technologies, standardization requirements, metrological support and life safety in the development and operation of radio engineering devices and information communications

								electronic devices. Mathematical model of fault tolerance of electronic devices. Factors influencing the fault tolerance of electronic devices.	systems .
PD	SRSS 4309	Satellite and radio relay communication systems	7	5	RET	Physics, theory of electrical communication, antenna-feeder devices and propagation of radio waves .	Design and operation of telecommunication networks .	Features of radio wave propagation in near-Earth space. Satellite communication systems; Basic principles of construction. Main characteristics, structure of consideration. steep segment. Structural diagram of the earth station. Energy calculation of the satellite communication line. Electromagnetic compatibility. General principles of radar construction. Principles of equipment construction. Determination of antenna support heights. Calculation of communication stability for digital radar. Hierarchy of digital signals. Methods of modulation, coding	PO1 Demonstrate knowledge of the basics of design and installation, be able to operate radio engineering and information telecommunications devices and systems, and be proficient in the methods of calculating electrical circuits. PO3 Have deep knowledge of information and computer technologies, the fundamentals and elemental base of telecommunications used in professional activities. PO4 Have a deep level of knowledge in the field of analog and digital electronic technologies, have experience in circuit modeling, demonstrate knowledge in the field of microprocessor systems and have skills in programming microcontrollers.

								and signal processing in digital radar.	PO5 Be able to carry out calculations for the design of information communications systems and networks, use modern software packages for calculations, modeling and design of electronic devices and information communications systems. PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices for processing and converting data transmission signals. PO7 Have knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless systems. PO8 Apply theoretical

									knowledge when solving problems of designing radio-electronic and information and communication systems.
PD	RRU 4314	Radio transmitting and receiving devices	7	5	RET	Wireless communication technologies , television and radio broadcasting.	Reliability of television and radio electronic equipment , Printed circuit board and surface mounting technology .	Functional diagrams of radio transmitting devices. Generator with emergency excitation. Methods of digital modulation in modern radio communication and radio access devices. The problem and ways to solve it in terms of building a highly efficient and high-quality increase in the productivity of multi-frequency OFDM signals. The main technical indicators and designs of radio receiving devices. Frequency converters. General information about radio receiving devices. Construction schemes. The main units of radio receiving devices.	PO1 Demonstrate knowledge of the basics of design and installation, be able to operate radio engineering and information telecommunications devices and systems, and be proficient in the methods of calculating electrical circuits. PO3 Have deep knowledge of information and computer technologies, the fundamentals and elemental base of telecommunications used in professional activities. PO4 Have a deep level of knowledge in the field of analog and digital electronic technologies, have experience in circuit modeling, demonstrate knowledge in the field of microprocessor systems and have skills

									in programming microcontrollers. PO5 Be able to carry out calculations for the design of information communications systems and networks, use modern software packages for calculations, modeling and design of electronic devices and information communications systems. PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices for processing and converting data transmission signals. PO7 Have knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless

									systems. PO8 Apply theoretical knowledge when solving problems of designing radio-electronic and information and communication systems.
PD	IV 4306	Internet of Things	8	5	RET	Mathematics II, information and communication technologies , algorithmization and programming in high-level languages , electronics and circuit engineering 1, digital devices and microprocessor technology 1 , digital communication theory , wireless communication technologies .	Research work of master's students; Experimental research work of master's students	Introduction to the Internet of Things. IoT application scenarios . Data transmission technologies for IoT . IoT hardware . Standard interfaces. Data processing, cloud storage. Practical work with devices.	PO4 Have a deep level of knowledge in the field of analog and digital electronic technologies, have experience in circuit modeling, demonstrate knowledge in the field of microprocessor systems and have skills in programming microcontrollers. PO5 Be able to carry out calculations for the design of information communications systems and networks, use modern software packages for calculations, modeling and design of electronic devices and information communications systems. PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices

									for processing and converting data transmission signals. PO7 Have knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless systems.
PD	OTT 4316	Cloud technologies of telecommunications	8	8	RET	Mathematics II, information and communication technologies, algorithms and programming in high-level languages, electronics and circuit engineering 1, digital devices and microprocessor technology 1, theory of digital communication, wireless communication technologies.	LPWAN for the Internet of Things	Intelligent information systems, IoT . Cloud network infrastructure. Cloud standards. Cloud production. Cloud application services. Cloud computing. Data centers. Storage systems. 5G technology. Virtual data implementation. Information security. Multiplexing and multiple access. Advanced collaboration	PO4 Have a deep level of knowledge in the field of analog and digital electronic technologies, have experience in circuit modeling, demonstrate knowledge in the field of microprocessor systems and have skills in programming microcontrollers. PO5 Be able to carry out calculations for the design of information communications systems and networks, use modern software

								methods. Source coding. Fading channels	packages for calculations, modeling and design of electronic devices and information communications systems. PO6 Have knowledge of the theory of electrical and digital communications, methods and principles of operation of devices for processing and converting data transmission signals. PO7 Have knowledge of the basics of radio electronic circuits and signals, radiation, propagation and reception of radio waves, distinguish between types of antenna-feeder devices, know wireless communication technologies and have an idea of their differences, be able to calculate a wireless data transmission network for wired and wireless systems.