Ministry of Agriculture of the Republic of Kazakhstan
Non-profit Joint Stock Company "S.Seifullin Kazakh Agrotechnical University"

CONSIDERED
at the meeting of the Scientist
University Council
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APPROVED
Dean of the Faculty Energy
S.Seifullin Kazakh Agrotechnical
University named
Isenov S.S.
05.09.2022

CATALOG OF ELECTIVE DISCIPLINES

Nur-Sultan 2022

Catalog of university and elective disciplines for the educational program 6B06202 Radio engineering and electronics.– Nur-Sultan, 2022. - 26 pages.

This catalog contains a list and content, post- and prerequisites, the volume of credits of disciplines of university and elective components offered by the university for the development of bachelor's and master's degree programs and is intended for students, undergraduates studying under the credit system.

Explanatory note

Dear students (undergraduates, doctoral students)! With the credit system of education, a mandatory element of the educational and methodological complex of the educational program is the catalog of university and elective disciplines (CED) in the field of training. The CED is a list of disciplines included in the university component and the component for the selection of educational programs in the framework of the training area 6B062 Telecommunications.

The catalog of disciplines is used by students when drawing up an individual curriculum, developed personally by the student under the guidance of an adviser, taking into account the individual abilities of the student, his growth prospects, the needs of the labor market and production.

The catalog offers disciplines that allow students to form their educational trajectory in accordance with the educational program within the framework of the training direction.

In order to form their educational trajectory, a student (undergraduate, doctoral student) must master all disciplines of compulsory and university components in accordance with the educational program, as well as choose several elective disciplines from the catalog for study.

After successful completion of this program, graduates will be able to demonstrate:

LO1 Possess deep knowledge in the field of natural and mathematical sciences and history.

LO2 Possess in-depth knowledge of information and computer technologies, fundamentals and elements of telecommunications used in professional activities.

LO3 Demonstrate knowledge of the basics of design and installation, be able to operate radio engineering and infotelecommunication devices and systems, possess methods of calculating electrical circuits.

LO4 Possess 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 possess microcontroller programming skills.

LO 5 To be able to carry out calculations for the design of systems and networks of telecommunications, to use modern software packages of computer programs for calculations, modeling and automation of design of radio electronic devices and systems of telecommunications.

LO 6 Have knowledge of the theory of electrical and digital communications, about the methods, principles of operation of devices for processing and converting data transmission signals.

LO 7 To know the basics of radio electronic circuits and signals, radiation, propagation and receiving of radio waves, to distinguish the types of antenna-feeder devices, to know the technology of wireless communication and to know of their differences, to be able to calculate the wireless data network of wired and wireless systems.

LO 8 Apply theoretical knowledge in solving problems of designing radio

electronic and infocommunication systems.

LO 9 To demonstrate knowledge of the modern technology, requirements of standardization, metrological support and life safety in the development and operation of radio equipment and information and communication systems.

LO 10 To know the state language and one foreign language for providing and documenting of information, to be able to use the normative and legal documentation, typical for the field of information and communication technologies and communication systems, to be ready to read the project and working technical documentation.

LO 11 To be ready to use the basics of philosophical, socio-political, economic and legal knowledge in practical engineering activities.

LO 12 Have a socio-humanitarian outlook, a common psychological culture of the future specialist in engineering and an adequate level of physical training.

Catalog of elective disciplines

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Ecology and life safety
5	Discipline code	EOBZh 1118
6	The cycle of discipline	GE/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Ecology
11	Course	1
12	Trimester	2
13	Prerequisites	Biology, Chemistry in the scope of the school curriculum
14	Post-requirements	Analysis of environmental conditions
15	Summary of the discipline (names of topics)	The laws of ecology as a theoretical basis for nature conservation and rational nature management, the relationship of organisms with environmental factors and habitat conditions, the biosphere-noosphere concept of V.I. Vernadsky, the concepts and concepts of sustainable development
16	Results of discipline training	LO9, LO11
17	The name of the Alternative Discipline for the discipline of the Component of choice	Climate change and the green economy

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Fundamentals of Economics and Law
5	Discipline code	OEP 2119
6	The cycle of discipline	GE/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Economy
11	Course	2
12	Trimester	4
13	Prerequisites	Philosophy. Modern history of Kazakhstan. Mathematics.
14	Post-requirements	Business planning
15	Summary of the discipline (names of topics)	The subject of economic theory and research methods. Fundamentals 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. Economic growth and instability of the market economy. Inflation and unemployment are manifestations of economic instability. Financial and monetary system in the national economy and economic security. Fundamentals of the theory of state and law. Fundamentals of constitutional law. Fundamentals of administrative law. Fundamentals of civil law. Fundamentals of labor law. Fundamentals of family law. Fundamentals of criminal law. Economic and legal aspects of land market regulation.
16	Results of discipline training	LO 11
17	The name of the Alternative Discipline for the discipline of the Component of choice	Business law

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Digital signal processing
5	Discipline code	COS 3223
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	8
13	Prerequisites	Mathematics III. Engineering mathematics, Theory of electrical circuits 2. Theory of electrical communication
14	Post-requirements	Wireless communication technologies
15	Summary of the discipline (names of topics)	Discrete signals. Discrete systems. Basics of digital filtering. Filtering of random signals. Computational process and computational algorithms. Digital frequency filters. Digital filters with linear phase. Deconvolution of signals. Deconvolution filters. The wavelet transform. Function wavelet. Discrete Karunen-Loev transform. Digital filter, optimal by the criterion of maximum signal-to-noise ratio. Special discrete random processes. Special discrete random processes.
16	Results of discipline training	LO1, LO2, LO5, LO6
17	The name of the Alternative Discipline for the discipline of the Component of choice	Fundamentals of signal processing theory

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Programming of telecommunication and radio electronic systems
5	Discipline code	PTRS 3210
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	4
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	8
13	Prerequisites	Algorithmization and programming in high-level languages. Fundamentals of Telecommunications, Mathematics. Digital devices and microprocessor technology 1.
14	Post-requirements	Design and operation of telecommunication networks, Packet and hybrid switching networks.
15	Summary of the discipline (names of topics)	The Python programming language. Comparison operators in Python. Advantages and disadvantages of the language. Data types. The equivalent of null None. Checking for None. The main modules. Operations on files and directories. High-level functions for creating and reading archived and compressed files. Request the size of the output terminal. The unittest module. Command line interface. Test detection. Organization of the test code. Success checks. The subprocess module. The fractions, cmath, glob, functools, os.path. Python modules for the Web.
16	Results of discipline training	LO1, LO2, LO4
17	The name of the Alternative Discipline for the discipline of the Component of choice	Programming of telecommunication and radio electronic systems in PROTEUS CAD

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	English for special purposes
5	Discipline code	AYaDSC 2228
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	6
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	2
12	Trimester	4
13	Prerequisites	Foreign language" in Bachelor's degree level B1-B2
14	Post-requirements	Disciplines in the specialty in a foreign language
15	Summary of the discipline (names of topics)	Features of written and oral speech, semantic and structural features of texts of various professional functional styles; compilation of detailed characteristics of correct speech, reading texts in the specialty; monologue, dialogic speech; conversational and everyday speech; linguistic speech in the specialty for the active use of a foreign language.
16	Results of discipline training	LO10
17	The name of the Alternative Discipline for the discipline of the Component of choice	Business communication in English

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Electromagnetic fields and waves
5	Discipline code	EPV 2224
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	2
12	Trimester	5
13	Prerequisites	Physics, Mathematics
14	Post-requirements	Satellite and radio relay and communication systems
15	Summary of the discipline (names of topics)	Basic laws of electrodynamics. The wave equation for the electromagnetic field. Plane electromagnetic waves in homogeneous and isotropic media Plane electromagnetic waves in media with frequency dispersion. Wave phenomena at the interface of media. Guided electromagnetic waves. Rectangular metal waveguides. Round metal waveguides. Volumetric resonators.
16	Results of discipline training	LO7
17	The name of the Alternative Discipline for the discipline of the Component of choice	Microwave electrodynamics

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Digital devices and microprocessor technology 2
5	Discipline code	CUMT 3215
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	8
13	Prerequisites	Mathematics 1, 2. Theory of electrical circuits. Digital devices and microprocessor technology 1. Electronics and circuitry 1,2.
14	Post-requirements	Software engineering. Embedded systems. Digital signal processing. Design on FPGA. Internet of Things.
15	Summary of the discipline (names of topics)	Basic definitions in microprocessor systems. Classification of MPS. Von Neumann principles. The architecture of the MPS. Memory in MPS. Classification of MPS teams. The composition of the MPS and EMF teams. The structure of the EMF. EMF output circuit and the purpose of the main elements. Programming of the MPS. ASSEMBLY language. Basic concepts. Interrupts in the MPS and working with them. Stack in MPS and work with it. Software model of MP. I/O interfaces of the MPS. The main stages of documenting the IPU programs.
16	Results of discipline training	LO1, LO2, LO4, LO5
17	The name of the Alternative Discipline for the discipline of the Component of choice	Microprocessor devices 2

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Electronics and circuitry 2
5	Discipline code	CUMT 3215
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	7
13	Prerequisites	Mathematics 1, 2. Theory of electrical circuits. Digital devices and microprocessor technology 1. Electronics and circuitry 1,2.
14	Post-requirements	Software engineering. Embedded systems. Digital signal processing. Design on FPGA. Internet of Things.
15	Summary of the discipline (names of topics)	Pulse devices. Algebra of logic. Logical messages, logical operations, the simplest logical elements. Basic logic elements. Types of logic chips. The main parameters of the IC. Combinational logic circuits. Varieties of KLS. Sequential integral KLS. Pulse distributors. Counters with an arbitrary score coefficient. Pulse counters. Digital-to-analog converters (DACs). Analog-to-digital converters (ADCs).
16	Results of discipline training	LO4, LO5
17	The name of the Alternative Discipline for the discipline of the Component of choice	Fundamentals of conversion technology

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Radio circuits and signals
5	Discipline code	RCS 2212
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	2
12	Trimester	6
13	Prerequisites	Mathematics 1, 2. Theory of electrical circuits. Digital devices and microprocessor technology 1. Electronics and circuitry 1,2.
14	Post-requirements	Software engineering. Embedded systems. Digital signal processing. Design on FPGA. Internet of Things.
15	Summary of the discipline (names of topics)	Classification of signals.Dynamic representation of signals. Geometric representation of signals. Generalized spectral representation of signals. Deterministic signals. Kotelnikov's theorem. The spectrum of a discrete signal.Modulated signals. Classification of types of modulation. Random signals.Elements of probability theory. Random processes and their probabilistic characteristics. The energy spectrum of a random process. Wiener-Hinchin theorem, Fundamentals of the theory of linear-parametric circuits. Discrete signal processing and digital filters. Optimal linear filtering of signals.
16	Results of discipline training	LO4, LO7
17	The name of the Alternative Discipline for the discipline of the Component of choice	Theoretical foundations of radio engineering

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Electrical and radio materials science
5	Discipline code	Ele 2229
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	3
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	2
12	Trimester	6
13	Prerequisites	Mathematics. Physics.
14	Post-requirements	Fundamentals of micro- and nanoelectronics. Physical fundamentals of electronic engineering materials, Special issues of micro, nano and optoelectronics.
15	Summary of the discipline (names of topics)	General information about electronic equipment materials. Types of communication in connections. Elements of the zone theory of solids. Conductive materials. Superconducting metals and alloys. Alloys for thermocouples. Refractory metals. Non-metallic conductive materials. Semiconductor materials. Proprietary and impurity semiconductors. Electrophysical phenomena in semiconductors. Silicon. Silicon carbide. Semiconductor compounds based on solid solutions. Dielectrics. Active dielectrics. Ferroelectrics. Piezoelectrics. Pyroelectrics. Electrettes. Liquid crystals. Materials for solid-state lasers. Magnetic materials.
16	Results of discipline training	LO1
17	The name of the Alternative Discipline for the discipline of the Component of choice	Materials and components of electronics

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Radio automation and telemetry
5	Discipline code	RT 3211
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	7
13	Prerequisites	Mathematics 1. Physics. Engineering mathematics, Theory of electrical circuits 1, 2. Electromagnetic fields and waves.
14	Post-requirements	Electronics and circuitry 2. Radio circuits and signals. Programming in teleradioelectronic devices and systems. CAD of electronic devices. Theory of digital communication. Wireless communication technologies, Satellite and radio relay and communication systems.
15	Summary of the discipline (names of topics)	Automatic control systems. Differential equations. transition and transfer functions. Frequency, logarithmic frequency characteristics of RA. Typical links of the system. Oscillatory, integrating links. Study of the stability of linear automatic control systems. Mikhailov's stability criterion. Converting a message into a signal and separating elements. Methods of election and group selection. The main nodes of the TU-TS devices. Amplification and translation points. Encryption, decryption node.
16	Results of discipline training	LO1,LO3,LO8
17	The name of the Alternative Discipline for the discipline of the Component of choice	Computer-aided design systems

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Technology of printed circuit boards and surface mounting
5	Discipline code	TPPPM 4216
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	10
13	Prerequisites	Mathematics 1. Physics. Engineering mathematics, Theory of electrical circuits 1, 2. Electromagnetic fields and waves.
14	Post-requirements	Electronics and circuitry 2. Radio circuits and signals. Programming in teleradioelectronic devices and systems. CAD of electronic devices. Theory of digital communication. Wireless communication technologies, Satellite and radio relay and communication systems.
15	Summary of the discipline (names of topics)	Development of printed circuit board manufacturing technology. Installation of electronic circuits in the housing and high-density interconnects. Physical characteristics of printed circuit boards. The process of designing printed circuit boards. Built-in components. High-density interconnects. High-density interconnect technology. Surface-mounted switching boards. Design of surface-mounted switching boards. Testing of mounted boards. Design of flexible printed circuit boards. Special designs of flexible boards.
16	Results of discipline training	LO3,LO5,LO9
17	The name of the Alternative Discipline for the discipline of the Component of choice	Fundamentals of surface mounting technology

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Academic writing
5	Discipline code	AP 4209
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	10
13	Prerequisites	"Foreign language" in Bachelor's degree level B1-B2
14	Post-requirements	Disciplines in the specialty in a foreign language
15	Summary of the discipline (names of topics)	Mastering and expanding the "academic" vocabulary: vocabulary of neutral and formal style, characteristic of such types of written speech as essays, articles, reports, official letters, etc.
16	Results of discipline training	LO10
17	The name of the Alternative Discipline for the discipline of the Component of choice	Effective Essay writing

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Internet of Things
5	Discipline code	AP 4209
6	The cycle of discipline	BD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	10
13	Prerequisites	Mathematics II. Information and communication technologies. Algorithmization and programming in high-level languages. Electronics and circuitry 1. Digital devices and microprocessor technology 1. Theory of digital communication. Wireless communication technologies.
14	Post-requirements	Research work of undergraduates; Experimental research work of undergraduates
15	Summary of the discipline (names of topics)	Introduction to the Internet of Things. IoT application scenarios. Data transfer technologies for iOS. Hardware Standard interfaces. Data processing, cloud storage. Practical work with devices.
16	Results of discipline training	LO4,LO6
17	The name of the Alternative Discipline for the discipline of the Component of choice	Cloud technologies telecommunications

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Reliability of tele-electronic equipment
5	Discipline code	NTA 4310
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	3
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	12
13	Prerequisites	Mathematics III. Physics. Engineering mathematics. Theory of electrical circuits 1,2. Digital devices and microprocessor technology 1,2.
14	Post-requirements	Design and operation of telecommunication networks. Satellite and RRL.
15	Summary of the discipline (names of topics)	Introduction to the Internet of Things. IoT application scenarios. Data transfer technologies for iOS. Hardware Standard interfaces. Data processing, cloud storage. Practical work with devices.
16	Results of discipline training	LO3,LO9
17	The name of the Alternative Discipline for the discipline of the Component of choice	Assessment of fault tolerance of electronic devices

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Software Engineering
5	Discipline code	PI 3306
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	4
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	8
13	Prerequisites	ICT. Engineering mathematics. Algorithmization and programming in high-level languages, Programming in teleradio-communication devices and systems.
14	Post-requirements	Embedded systems, the Internet of Things.
15	Summary of the discipline (names of topics)	Life cycle models and profiles. Life cycle processes of software tools of microprocessor and embedded systems. Project management of automation systems software tools. The main processes of software engineering. General issues of performing software engineering processes. Methods and tools of software engineering. Formal and applied models of software engineering. Using the methodology of Systems Theory and system analysis in software engineering.
16	Results of discipline training	LO2,LO4,LO5,LO8
17	The name of the Alternative Discipline for the discipline of the Component of choice	Software Engineering and LabVIEW

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Business planning
5	Discipline code	BP 4307
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Economy
11	Course	4
12	Trimester	12
13	Prerequisites	Fundamentals of Economics and Law
14	Post-requirements	Diploma design
15	Summary of the discipline (names of topics)	The business plan of an agro-industrial enterprise as the basis for the implementation of an entrepreneurial idea. Business planning as an element of the company's economic policy. Organization of business planning. The place and role of a business plan in business management. Analytical sections of a typical business plan at enterprises. Key sections of a typical business plan. The main elements of business planning. Business planning technology. Managerial business plan of an agricultural enterprise. Business plans of projects and solutions to practical problems of business management.
16	Results of discipline training	LO5
17	The name of the Alternative Discipline for the discipline of the Component of choice	Entrepreneurship

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Computer-aided design system (CAD) of electronic devices
5	Discipline code	SAPSEU 4313
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	4
12	Trimester	12
13	Prerequisites	Theory of electrical circuits 1,2. Electronics and circuit engineering 1,2. Digital devices and microprocessor technology 1.
14	Post-requirements	Technology of printed circuit boards and surface mounting
15	Summary of the discipline (names of topics)	Integrated circuit design methodology. Design principles. Design methods. Stages of designing electronic devices. Development of the specification. Logical design. Circuit design. Topological design. Component design. CAD architecture of electronic devices. Software design tools. VLSI design routes. Automation of design of semi-order VLSI. Automation of custom VLSI design. CADENCE design tools. SYNOPSYS design tools. MENTOR GRAPHICS design tools.
16	Results of discipline training	LO3,LO6,LO9
17	The name of the Alternative Discipline for the discipline of the Component of choice	Automation of design and technological design of electronic means

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Television and radio broadcasting
5	Discipline code	TR 3308
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	9
13	Prerequisites	Digital devices and microprocessor technology 1. Antenna-feeder devices and radio wave propagation.
14	Post-requirements	Packet and hybrid switching networks. Technologies of transport communication networks. Satellite and radio relay and communication systems. Radio transmitting and receiving devices. Digital signal processing.
15	Summary of the discipline (names of topics)	Conversion of an optical image into an electrical signal. Block diagram of the television system. Principles of construction of converters. Sensors of television signals and their characteristics. Color television systems. Colorimetric determination of color. Digital representation of image signals. Compression of digital television signals. Video compression according to MPEG-1,2,4 and MPEG-7 standards. Digital modulation of video signals. Digital TV broadcasting DVB. Radio broadcasting systems. Radio broadcasting in the DV, SV and KV bands. Digital radio broadcasting.
16	Results of discipline training	LO6,LO7,LO10
17	The name of the Alternative Discipline for the discipline of the Component of choice	Broadcasting systems

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Wireless communication technologies
5	Discipline code	TBS 3309
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	9
13	Prerequisites	Mathematics 1,2. Engineering mathematics. Physics. Electromagnetic fields and waves. Theory of electrical circuits 2. Digital communication theory, Digital signal processing
14	Post-requirements	Internet of Things. Satellite and radio relay and communication systems
15	Summary of the discipline (names of topics)	Classification of wireless communications Methods of spectrum conversion using a carrier. Amplitude, frequency, two-position phase manipulation. Coherent and incoherent detection. Multi-position phase and quadrature amplitude modulation. Multiple access. Methods of spectrum expansion. Features of the transmission channel in wireless systems. Models for calculating signal power losses. The concept, components, principles and systems of the cellular network. Trunking systems. Cordless telephony. Standards IEEE 805.15.X., IEEE 802.15.4: , 802.11. LP VAN technology.
16	Results of discipline training	LO6,LO7
17	The name of the Alternative Discipline for the discipline of the Component of choice	Basics of mobile communication systems

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Radio transmitting and receiving devices
5	Discipline code	RRU 3312
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	5
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	9
13	Prerequisites	Technologies of wireless communication, Television and radio broadcasting.
14	Post-requirements	Reliability of tele-electronic equipment, Technology of printed circuit boards and surface mounting.
15	Summary of the discipline (names of topics)	Functional schemes of radio transmitting devices. Generator with external excitation. Digital modulation methods in modern radio communication and radio access devices. The problems and ways of its resolution in terms of building a highly efficient and high-quality power amplification of multi-frequency signals OFDM type. The main technical indicators and structures of radio receivers. Frequency converters. General information about radio receivers. Construction schemes. The main components of radio receiving devices. Broadcasting receivers, technical characteristics, block diagrams. Television receivers.
16	Results of discipline training	LO3, LO4, LO6,LO7,LO8
17	The name of the Alternative Discipline for the discipline of the Component of choice	Radio engineering devices

1	Name of the direction of training	6B062 Telecommunications
2	Name of the group of educational programs	B059 Communications and communication technologies
3	Code and name of the educational program	6B06202 Radio engineering and electronics
4	Name of the discipline	Data transfer protocols
5	Discipline code	PPD 3314
6	The cycle of discipline	PD/CC
7	Component	by choice
8	Number of credits	4
9	Level of training	bachelor course
10	Department	Radio engineering, electronics and telecommunications
11	Course	3
12	Trimester	9
13	Prerequisites	Theory of digital communication, Wireless Communication Technologies, Fundamentals of Telecommunications, Theory of Electrical communication
14	Post-requirements	Design and operation of telecommunication networks
15	Summary of the discipline (names of topics)	The concept punctured the protocol stack. Presentation of protocols by functional purpose. Organizations (IETF, IEEE, ISO, ITU-T) involved in the development and regulatory protocols. The Basic Reference Model Of Open Systems Interaction Is ISO/OSI. Levels, tasks performed and corresponding protocols. Comparison of the OSI model and other models. TCP/IP, IPX/SPX protocol family. Protocol stacks of NetBIOS/SMB, Novell NetWare, DECnet. Protocols X.25, Frame Relay, MPLS, FTP. Telephony protocols V5, VoIP.
16	Results of discipline training	LO4, LO6
17	The name of the Alternative Discipline for the discipline of the Component of choice	Special network protocols of sensor networks

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16	Results of discipline training	LO4, LO6
17	The name of the Alternative Discipline for the discipline of the Component of choice	Special network protocols of sensor networks

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