

**Ministry of Education and Science of the Republic of Kazakhstan  
Non-commercial Joint Stock Company «Holding «Kasipkor»**

**EDUCATIONAL PROGRAM**

**Specialty 0502000** Maintenance and repair of telecommunications equipment and household appliances  
(of the fields)

**Qualification:** Master on repair and maintenance of telecommunication and electronic equipment

Video surveillance and burglar alarm systems setter

Electronic technician

Junior electronic engineer

**Astana – 2016**

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**INTRODUCED BY:** Non-commercial Joint Stock Company “Holding  
“Kasipkor”

**REVIEWED, APPROVED AND RECOMMENDED BY**

On the meeting of the Republican Educational and Methodological Board for Technical and Vocational Education of the Department of Education and Science of the Republic of Kazakhstan,

Minutes No. 4 dated « 21 » 12 2016

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## **1. Explanatory Note to the educational program**

This educational program is based on modular competence-based approach in accordance with international modern requirements for mid-level professionals and skilled workers, with the participation of foreign partner Dudley college (UK).

International experience, structure and content of training programs and training of technical and service staff that are used in several European countries:

- focused on the acquisition of a number of competencies in the curriculum and educational programs on a specialty;
- in the structure and content differ from the traditional subject - cyclic approach to the description of the content of technical and special disciplines and types of training and production work;
- disciplines of general professional and professional training are combined into several modules aimed at the qualification competences;
- requires the development of training modules, aimed at the performance of certain types of qualification competences of future professional activity.

The developers of this educational program have considered the above features of the educational programs of the European countries, the international concept of learning throughout whole life, as the content of educational programs aimed at the formation of professional competence of future professionals capable of adapting to changing situations at work, on the one hand, and going on professional development and education - on the other hand.

Also there have been considered the general requirements of the State Compulsory Educational Standard (hereinafter the “CES”) for Technical and Vocational Education, and applied to it the structure of the model curricula and requirements for knowledge, skills and competencies by level of qualifications established in professional standards.

In the development of this educational program based on the modular competency approach and the need for the introduction of modular training on preparation of cadres of skilled workers and mid-level professionals following key definitions are used:

Modular training program is a part of the educational program, aimed at the development of knowledge, skills and competencies required to perform certain professional activities within the same specialty;

Module is an independent, self-sufficient and complete profile of the educational program or training period;

Working curriculum is a document developed by the organization of technical and vocational education for a particular discipline, internships / practices, and other learning activities (modules) of the working curriculum on the basis of a model curriculum;

Modular unit is a logically acceptable division of labor in a particular

profession, having a clear beginning and end of work, which can be divided further which result is a product, a service or part of the work (working operation). This is the definition of the ILO (International Labour Organization);

Training module (modular training unit) is a set of sections (subjects) of learning content within a single training module (discipline), which provides the knowledge and performance of specific skills of the future qualifications;

Qualification is a level of training for the competent implementation of certain activities in specialty received;

Plan of training process (curriculum) is a document regulating the list, sequence, amount (workload) of disciplines (modules), internships / practices, and other types of educational activity of students of the appropriate level of education and forms of control;

Choice of structure and procedure for the formation of the content of educational programs by special modules or general professional disciplines and all types of training activities are provided by the developers in terms of the modular competence-based approach.

The modular approach to organization of teaching process allows for educational institutions to create conditions for selection of professional modules by students in order to obtain the necessary qualifications in the organization of teaching process in which the student can and should take over control his / her learning, which teaches him / her to take responsibility for own learning, and in the future - for own professional growth and career. Thus, the student, as a consumer, will be satisfied with the education; can improve it throughout whole life, in response to changes in the labor market.

This educational program on a specialty contains information on the respective skill levels, professional profiles, syllabuses, requirements for candidates and implementation of vocational education. At the same time, it takes into account the requirements for competency skill levels 3, 4 and 5 of the National Qualifications Framework of the Republic of Kazakhstan.

The educational program on a specialty is designed to meet guidelines:

- Articles 17, 20 and 28 of the Law of the Republic of Kazakhstan “On Education”;
- State educational standards for technical and vocational education. General provisions;
- Message of the President of the Republic of Kazakhstan, Nursultan Nazarbayev to People of Kazakhstan “Strategy” Kazakhstan-2050”;
- State program on industrial-innovative development of the Republic of Kazakhstan for 2015-2019;
- State Program of Education and Science Development of the Republic of Kazakhstan for 2016-2019;
- Development Strategy of “Holding “Kasipkor” Nonprofit Joint-Stock Company for 2012-2021;

The name and number of professional (special) modules are determined by developers in accordance with the National Qualifications Framework (NQF) and types of professional activities (competence) stipulated by professional standards in the specialty **“Maintenance and repair of telecommunications equipment and household appliances (by industry)”**. Based on the requirements (to the competence of a specialist) of professional standards / qualifications in the specialty, taking into account the estimated period of training the developers have identified general professional modules that are common to all types of professional activities (competence) on the specified qualifications: (“Material science”, “Occupational health and safety work”, etc.).

In determining names of the main special modules there are used the Qualifier of specialties of vocational and professional education, professional standards, which show all the possible types and levels of qualifications within the chosen specialty and description of the sequence of the complete cycle of production activities specified in the functional analysis of this specialty.

Based on the functional analysis of the types and levels of qualifications in view of the content of the educational programs of the specialty “Maintenance and repair of telecommunications equipment and household appliances (by industry)” at least 4 kinds of professional activities are defined that allow obtaining the following qualifications:

- 1) Master on repair and maintenance of telecommunication and electronic equipment;
- 2) Video surveillance and burglar alarm systems setter system
- 3) Electronic Technician;
- 4) Junior Electronic Technician.

The requirements for the structure and content of educational programs of this specialty at the level of technical and vocational education and post-secondary provide for the possibility:

- 1) assignment of fixed and/or high levels (grade, category) of qualifications for this specialty - upon graduation and passing the final certification of students - fettle tradesman for maintenance and service of telecommunication and electronic equipment; Video surveillance and burglar alarm systems setter system;
- 2) assignment of the mid-ranking expert - upon completion of the appropriate level of training and passing the final certification of students - electronic technician;
- 3) assignment of bachelor of applied science (assistant electronic

engineer) - upon graduation in tertiary college and passing the final attestation by students.

Taking into account international experience in designing educational, technical and vocational education programs:

- In this educational program, all training modules are aimed at the competence by types and levels of the prescribed qualification within this specialty;

- The educational program is focused on creative work of teachers to clarify the content of the training modules, taking into account the specific requirements of employers and the changes taking place in the industry in the preparation of working training programs;

- Determination and description of the full content of certain training modules is carried out by education institution, i.e., teachers on the basis of these learning outcomes for each module.

- Structure and content of professional training modules include the appropriate sections and subjects of laboratory-practical classes and industrial training.

However, the structure of the applied plan of the educational process (approximately) includes separate modules for the industrial training classes and professional practice. The purpose and subject of this module are focused on the consolidation and exercise of skills obtained in the training process in the framework of professional training modules under real operating conditions at the production site. Training modules of vocational training and professional internship/practice in real operating conditions provide for introductory, industrial and technological internship/practice at the production site. The content of these types of educational work (professional module) is determined by institution for technical and vocational education together with representatives of the enterprises selected as a practice base. Since the types of production work included in the curricula of professional practice depends on the conditions of the process organized in enterprises.

The total amount of teaching time allocated to all types of study in addition to theoretical training based on the integration of educational training programs for skilled workers and mid-level specialists are not less than 50% of the total amount.

In order to introduce this program in the practice of the institution, depending on the features of the labor market in the region and the wishes of the employer-client, the institution needs to develop effective curricula and programs.

## 2. LIST OF ACRONYMS AND DESIGNATIONS

**TVPSE** –technicalandvocationalpost-secondaryeducation;

**ED**–educationalprogram – it is a single set of basic characteristics of education, which includes the objectives, outcomes and content of the training, classroom management, ways and methods of implementation and criteria for assessing the education outcomes;

**NQF**- National Qualifications Framework defines a uniform scale of the levels of qualification of general competence for the development of sectoral qualifications frameworks and professional standards. NQC provides cross-industry comparability of qualifications and competences being the basis for a system of conformity assurance and the award of specialist qualifications;

**SQF**–sectoralqualificationsframework – a structured description of qualification levels, recognized in the industry;

**PC** - professional competence;

**BC**–basic competence;

**MM** – mandatory modules;

**EM**– educational modules;

**AHM**– all-humanitarian modules;

**SEM**– socioeconomic modules;

**PM**– professional (special) modules;

**BPM**– basic general professional modules;

**MDI**– modulesdeterminedbyinstitution;

**IT&PI**– industrialtrainingandprofessional internship;

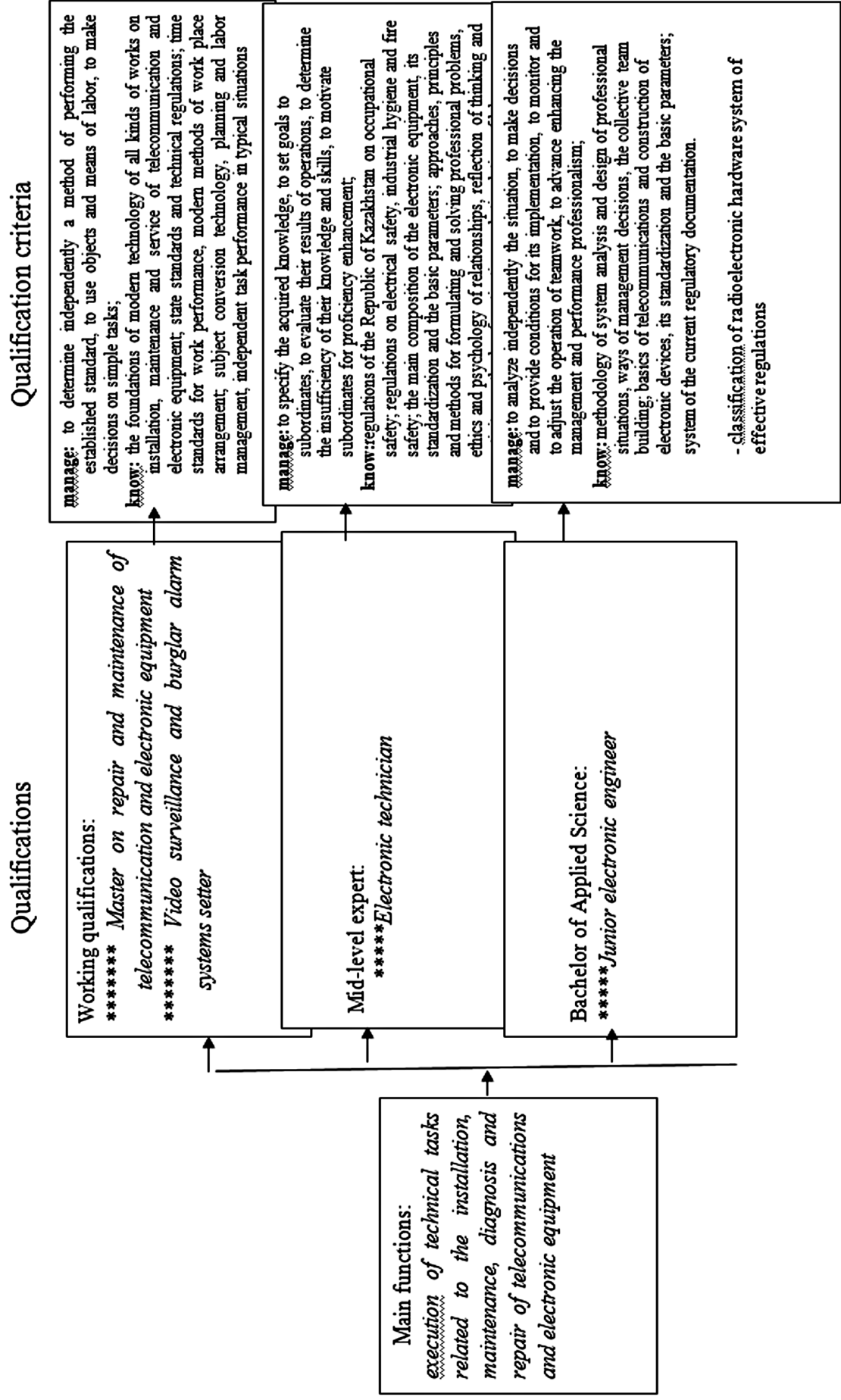
**HACCP** – hazardanalysisandcriticalcontrolpoint;

**DGRK**– decree of the Government of the Republic of Kazakhstan;



### 3. FUNCTIONAL ANALYSIS

Speciality 0502000 Service and Maintenance of Telecommunication Equipment and Household Appliances (by industries)



## 4. REQUIREMENTS TO DEGREE OF TRAINING OF STUDENTS

The section “Requirements to degree of training of students” defines the necessary basic competencies and professional competence on the levels of related qualifications of specialty (*Table 1*) in accordance with the National Qualifications Framework, sectoral qualifications frameworks and professional standards

Table 1

Com- pe- tences	Industrial/enterprise requirements to the education degrees of students			
Basic com- petences	Bach- elor of Applied Sci- ence: - Junior elec- tronic engi- neer	<i>“Elec- tronic techni- cian” (mid- ranking expert)</i>	<i>Master on repair and mainte- nance of telecom- munica- tion and electronic equip- ment; Video sur- veillance and bur- glar alarm systems setter; (advanced level)</i>	BC 2.1. to understand the nature and the social importance of their future profession, to show sustained interest to it; BC2.2. to be capable of systemic actions in profes- sional situations, to the analysis and design of its activities, to act independently in the face of uncer- tainty; BC2.3. to improve constantly its skills, knowledge in accordance with modern requirements; BC2.4. to perform work in conditions of division under the supervision of specialists of higher qualifi- cation; BC 2.5. to comply with the requirements of legisla- tion of the Republic of Kazakhstan and approved regulatory sectoral legislations; BC 2.6. to observe safety precautions, rules and regulations of occupational safety, industrial health and fire safety
				BC 3.1. to be ready to exercise responsibility for work conducted, to be capable of solving problems independently and effectively in the field of professional activity; BC 3.2. to be capable of self-definition of tasks, arrangement and supervision of the implementation of the standards by subordi- nate employees, responsibility for the outcome
				BC 4.1. to be capable of practice solving professional problems in the ar- rangement of different business legal structures; BC 4.2. to be ready for the management activities within the site, the pro- cess and strategies for the enterprise activity.

Professional competences	<b>Bachelor of Applied Science:</b> <b>- Junior electronic engineer</b>	<b>- Electronic technician»</b>  (mid-ranking expert)	<b>- Master on repair and maintenance of telecommunication and electronic equipment - Video surveillance and burglar alarm systems setter;</b> (advanced level)	<p>PC 2.1. to prepare workstation in compliance with the safety conditions for the implementation of the planned work;</p> <p>PC 2.2. to perform consistently technological operations for maintenance and service of various types of telecommunications and electronic equipment, antennas and distribution networks in accordance with the technical requirements;</p> <p>PC 2.3. to comply with the instructions when operated at instrumentation and measuring devices;</p> <p>PC 2.4. to read and to understand the principle diagrams - electric, assembly and structural diagrams;</p> <p>PC 2.5. to be able to use computer programs for diagnostics and fault finding;</p> <p>PC 2.6. to work with technical literature and documentation;</p> <p>PC 2.7. to determine the indications of electrical measuring instruments and to conduct analysis of their results.</p>
				<p>PC 3.1. to specify the tasks received, to set goals to subordinates, to evaluate their activity results;</p> <p>PC 3.2. to determine the lack of their knowledge and skills, to motivate the proficiency enhancement of subordinate employees;</p> <p>PC 3.3. execution of technical documentation in accordance with the current regulatory framework.</p>
				<p>PC 4.1. to analyze independently the situation, to make decisions and to create conditions for implementation;</p> <p>PC 4.2. to adjust activities in the context of team work by using the management and executive professionalism.</p>

## 5. EDUCATIONAL PROGRAM STRUCTURE

Professional competences	Educational module	Learning goals			Code of basic competence generated
		Knowledge	Skills	Attains	
	Basic modules				
PC 2.1 PC 2.2 PC 2.3 PC 2.4	<b>BPM-01 Electronic equipment installation</b> understanding of the installation of electronic devices, application, practical skills for installation works, grasp of instrument, compliance with safety regulations when performing installation work.	-The main directions in the field of occupational safety and health -Basic information about the dangers of working with electricity. -hazardous voltage - Protective equipment electrical work performance - HSE for fitter’s works - HSE for installation works - HSE for plumbing works - HSE for electric and mechanical tools - HSE for operation of soldering stations - ESD protection - Environmental security, drawings design rules; geometric structures and rules of drawing outlines of technical details - legend on electric diagrams; - tool and equipment for installation works; - types and methods of soldering of electronic components - materials for soldering - methods of testing components before installation - terminology and units of measurement in accordance with the applicable regulations and international SI system.	- To read simple electrical circuits - To apply the necessary materials and equipment to carry out installation work - To check radioactive elements before installation - To observe safety precautions - To be able to teamwork - To explain the laws of electricity (Ohm, Kirchhoff) - To use electrical values.	- reading electrical circuits; - installation and checking the quality of assembled elements; - to fix the noticed defects	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7
PC 2.1 PC 2.2 PC 2.3 PC 2.4	<b>BPM-02 Installation, service and maintenance of switching devices</b> Installation, maintenance and service of switching diveces, scope of application, practical skills for installation, maintenance and service of switching devices, grasp of instrument, compliance with safety regulations during the installation, maintenance and service of switching devices	- Safety regulation during installation of switching devices; - Safety regulation during service of switching devices; - Safety regulation during maintenance of switching devices; - Types of switching devices and designation on electrical diagrams; - Specifications of switching devices; - Methods of installation and switching of the switching devices; - Types of service and maintenance of switching devices; - Installation regulations in accordance with industry standard	- to distinguish the switching devices by intended purpose and methods of installation; - to use all the necessary tools and equipment for the installation and service of switching devices; - to comply with the maintenance procedure according to IS; - to read the electrical diagrams with switching devices	- installation, service and maintenance of switching devices; - in the use of diagnostic and fitting and assembly tool; - registration of the necessary technical documentation	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7

PC 2.1 PC 2.2 PC 2.3 PC 2.4	<b>BPM-03 Installation, maintenance and adjustment of power supply</b> skills and knowledge necessary for the maintenance and adjustment of power supply. The knowledge and practical skills gained from this course are used by the students for maintenance and adjustment of power supply and for learning other disciplines. The course content is designed to show the importance of electrical terminology, reading of electrical diagrams and the conditions of admission qualifications for the use of electronic equipment. Training allows the student to learn more about the graphics, principles of operation, methods of checking, maintenance and supervision, tools used for maintenance and adjustment of power supply.	- Workplace arrangement for installation and maintenance of power supply - Safety precautions for installation of power supply - Safety precautions for power supply inspection - Safety precautions for maintenance of power supply - Graphical symbols of radio elements of power supply - Electric charge. Potential difference. EMF. Power supply in AC electric circuits. Power supplies in DC electrical circuits. - Transformers, semiconductor rectifiers of power supply. Stabilizers of power supply voltages. SMPS operation - Radio elements and operation of the power sources - Workplace arrangement, troubleshooting technique for power supply.	- to use structural, assembly and schematic electrical diagrams of various types of power supply. - to calculate the primary power supply and selection of secondary power supply. - to use operating voltage of power supply. - to determine the serviceability of radio elements of power supply, to evaluate power supply operation, to receive the data on the individual power supply unit operation, to use the collected data on characteristics of the power source. - to arrange the workplace, to evaluate the power supply operation, to troubleshoot power supplies, to dismantle and to install radio elements - to carry out maintenance and adjustment of power supplies	- determination of serviceability of radio elements of power supply; - verification of radio elements of power supply; - verification of the data on the individual power supply unit operation; - use of the collected data on characteristics of the power supply; - analysis of conducted power measurements; - workplace arrangement; - repair and adjustment of power supplies	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7
<b>Professional modules</b> <b>For Special Field: Fitter Tradesman for maintenance and service of telecommunication and electronic equipment</b>					
PC 2.1 PC 2.2 PC 2.3 PC 2.4	<b>PM-01 Installation, maintenance and adjustment of LF amplifiers</b> skills and knowledge necessary for maintenance, tuning and adjustment of low frequency amplifiers. The knowledge and practical skills gained from this course are used by the students in the maintenance, tuning and adjusting the low-frequency amplifiers and for learning other disciplines. The course content is designed to show the importance of electrical terminology, reading of electrical circuits and the conditions of admission qualification for the use of electronic equipment. During training, the student gets acquainted with the graphic symbols, principles of operation, methods of inspection, maintenance and control, instruments and devices for setting and adjusting the low-frequency amplifiers.	- Workplace arrangement for the service and maintenance of low-frequency amplifiers - Safety precautions for maintenance and service of low-frequency amplifiers - ESD protection - Environmental Safety - Sources of signals of low frequencies . Operating range of amplified frequencies. The dynamic range of amplitudes. - Types of low frequency amplifiers - The operation principle of the amplifier transistor - Push-pull amplifier - Phase inversion stage of amplifier - Transformer low-frequency amplifier - Amplifying stages FET. - Amplifier stage diagrams of operational amplifiers. - Graphic Equalizer Circuits	- to read the block diagrams of the low-frequency amplifiers; - to read circuit diagrams of low frequency amplifiers; - to use measuring instruments; - to carry out inspection of modes of low-frequency amplifiers; - to determine the failure of low-frequency amplifiers; - to troubleshoot low-frequency amplifiers	- to use personal protective equipment; - to read electrical schematics and flow diagrams of electric equipment; - to service low-frequency amplifiers; - to identify and to troubleshoot the low-frequency amplifiers; - to use instrumentation for configuration, adjustment and maintenance of low-frequency amplifiers in the analysis of the performance measurements; - execution of necessary reporting documentation	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7

PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7	<b>PM-02 Installation, maintenance and adjustment of combined devices for magnetic and optical recording and audio-video reproduction.</b> It is aimed at arrangement and methodology of maintenance, tuning and adjustment of the combined devices for magnetic and optical recording and audio-video reproduction, scope of application, practical skills in carrying out maintenance, setup and adjustment of the combined devices for magnetic and optical recording and audio-video reproduction, the grasp of an instrument, compliance with safety precautions for maintenance, tuning and adjustment of combined devices for magnetic and optical recording and audio-video reproduction.	- Workplace arrangement for service and maintenance of combined devices and devices for magnetic and optical recording and audio-video reproduction; - Safety precautions for service and maintenance of combined devices; - ESD protection; - Ecology in the maintenance of combined devices	- to determine the serviceability of nodes of combined devices for magnetic and optical recording and reproducing. - to carry out checks of radio elements of combined devices for magnetic and optical recording and reproducing. - to use the method of measuring the operation modes of combined devices for magnetic and optical recording and reproducing. - to use the collected data on the frequency characteristics of the operation. - to carry out the analysis of the measurements of combined devices for magnetic and optical recording and reproducing. - to diagnose the operation of combined devices for magnetic and optical recording and reproducing. - to evaluate the operation of combined devices for magnetic and optical recording and reproducing. - to identify failure of combined devices for magnetic and optical recording and reproducing. - to conduct dismantle and installation of radio elements of combined devices for magnetic and optical recording and reproducing. - to carry out maintenance and tuning of combined devices for magnetic and optical recording and reproducing	application of personal protective equipment - to read electrical and flow diagrams of electrical equipment - to service combined devices for magnetic and optical recording and audio-video reproduction - identification and troubleshooting of combined devices for magnetic and optical recording and audio-video reproduction - to use instrumentation for tuning, adjustment and maintenance of combined devices for magnetic and optical recording and audio-video reproduction analysis of the performance measurements - execution of necessary reporting documentation	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7
PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7	<b>PM-03 Installation, maintenance and adjustment of TV hardware with CRT and LCD, plasma and LED displays</b> The knowledge and practical skills gained from this course are used by students in maintenance, tuning and adjustment of television equipment. The course content is designed to show the importance of electrical terminology, reading of electrical diagrams and the conditions of admission qualifications for the use of electronic equipment. In training, the student gets acquainted with the graphics, principles of operation, methods of inspection, maintenance and control instruments and devices for tuning and adjustment of television equipment.	- Workplace arrangement for service and maintenance of television equipment; - Safety precaution for service and maintenance of television equipment; - ESD protection; - Ecology in the maintenance of television equipment	- To determine the serviceability of television equipment units. To perform inspection of radio elements television equipment. To use the measurement method of operation modes of television equipment. To use the collected data of the operation frequency characteristics. To make the analysis of the measurements of television equipment. To diagnose the operation of television equipment. To evaluate the operation of television equipment. To identify the problem of nodes and television equipment units. To dismantle and to install radio elements of television equipment. To perform maintenance and adjustment of television equipment.	in the application of personal protective equipment - to read electrical and flow diagrams of electrical equipment; - to maintain television equipment with CRT and application of LCD, plasma and LED displays - to identify and to troubleshoot television equipment with CRT and application of LCD, plasma and LED displays; - to use instrumentation for tuning, adjustment and maintenance of television equipment with CRT and application of LCD, plasma and LED displays in the analysis of the performance measurements - execution of necessary reporting documentation	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6 BC 2.7
<b>For Special Field: Electronic technician</b>					



PC 2.4 PC 2.5 PC 2.6 PC 3.1 PC 3.2 PC3.3	<b>PM-04 Maintenance of digital audio-video recording equipment</b> It is intended to show the importance of electrical terminology, reading of electrical circuits and the conditions of admission qualification for the use of electronic equipment. During training, the student gets acquainted with the graphics, principles of operation, methods of inspection, maintenance and supervision, instruments and devices for tuning and adjusting digital audio-video recording equipment. Whereas, the students acquire theoretical and practical knowledge aimed at development of practical skills for service and maintenance of electronic equipment	- Workplace arrangement for the service and maintenance of digital audio-video recording equipment; - Safety precautions for maintenance and service of digital audio-video equipment; - ESD protection during maintenance; - Ecology in the maintenance of digital audio-video recording equipment	- to read design and technological documentation for the special field; - to determine polarity and voltage in electronic components and circuits by metering equipment - to conduct system troubleshooting in impulse and digital circuits To produce a systematic troubleshooting in the digital diagram and in digital integrated circuits. - to have skills in diagnostic of performance of digital audio-video recording equipment; - to detect the cause of the fault of digital devices under maintenance. - to make cleaning and service of digital audio-video recording equipment with the use of special funds To make the maintenance, adjustment and service of digital equipment	in the application of personal protective equipment - to read electrical and flow diagrams of electrical equipment - to maintain the digital audio-video equipment; - to identify and to correct the faults of digital audio-video equipment; - to use metering and monitoring instruments for settings, adjustment and maintenance of digital audio-video equipment in the analysis of the measurements - to execute necessary reporting documentation to execute the design, technological and other technical documentation in accordance with the current regulatory framework	BC 3.1 BC 3.2
PC 2.4 PC 2.5 PC 2.6 PC 3.1 PC 3.2 PC3.3	<b>PM-05 Maintenance of satellite transceiving equipment</b>	- Workplace arrangement for service and maintenance of satellite transceiving equipment; - Safety precautions for maintenance and service of satellite transceiving equipment; - ESD protection during maintenance; - Ecology for maintenance of satellite transceiving equipment	To determine the polarity and voltage in electronic components and circuits - To use the appliance to determine the satellite signal level; To use the device to fine-tune the satellite antenna to the satellite; - To have skills of diagnostics of satellite transceiving equipment performance. - To assemble satellite antenna. - To install a satellite antenna and equipment. - To carry out the configuration of satellite equipment. To perform service and maintenance of satellite equipment.	in the application of personal protective equipment - to read electrical and flow diagrams of electrical equipment - to maintain satellite transceiving equipment; - to identify and to troubleshoot satellite transceiving equipment; - to use instrumentation for configuration, adjustment and maintenance of satellite transceiving equipment; in the analysis of conducted performance measurements; - execution of required reporting documentation	BC 3.1 BC 3.2

PC 2.4 PC 2.5 PC 2.6 PC 3.1 PC 3.2 PC3.3	<b>PM-06 Maintenance of electronic hardware with new equipment</b>	<ul style="list-style-type: none"> <li>- Workplace arrangement for service and maintenance of electronic equipment</li> <li>2. Safety precautions for service and maintenance of electronic equipment</li> <li>3. ESD protection during maintenance</li> <li>4. Ecology in the maintenance of electronic equipment</li> <li>Designation on all electrical circuits</li> <li>- principle of operation of various electronic equipment</li> <li>- specifications</li> <li>- methods of identification and troubleshooting using new technologies</li> <li>- safety precautions for electronic equipment service and maintenance</li> <li>- necessary operational and technical documentation</li> </ul>	<ul style="list-style-type: none"> <li>- to read a variety of circuits of electronic equipment</li> <li>- diagnostics and troubleshooting</li> <li>- to calculate the current and voltage on the circuit sections;</li> <li>- to determine the type and design of communication devices</li> <li>- to install hardware for printing equipment.</li> <li>- to evaluate operation of scanning devices</li> <li>1 To determine the performance of electronic equipment with the use of new hardware using monitoring and metering</li> <li>- to perform inspection and replacement of cables and connectors to them.</li> <li>- to fill the cartridge tank.</li> <li>- to install the toner reservoir</li> <li>- to be able to repair the printing mechanism in the printing device.</li> <li>- to perform maintenance and service of electronic equipment with new hardware.</li> </ul>	<ul style="list-style-type: none"> <li>in the application of personal protective equipment</li> <li>-to read electrical and flow diagrams of electrical equipment</li> <li>-to maintain the electronic equipment</li> <li>- to identify and to troubleshoot electronic equipment</li> <li>-to use instrumentation for configuration, adjustment and maintenance of electronic equipment</li> <li>in the analysis of conducted performance measurements</li> <li>-execution of required reporting documentation</li> <li>- to carry out installation of various actuators, to connect them according to design documentation.</li> <li>- for maintenance of various electronic equipment</li> </ul>	BC 3.1 BC 3.2
PC 2.4 PC 2.5 PC 2.6 PC 3.1 PC 3.2 PC3.3	<b>PM-07 Execution of regulatory documents</b>	<ul style="list-style-type: none"> <li>PC configuration and software</li> <li>- types of regulatory technical and operational documentation;</li> <li>- rules of reception and processing of orders for maintenance and repair according to IS;</li> <li>- list of documents for commissioning; - required documentation in the production of all types of service and maintenance;</li> <li>- job descriptions, technical operation rules, instructions on safety and labor protection;</li> <li>- legal and entitling documents</li> </ul>	<ul style="list-style-type: none"> <li>- to be able to work in Word, Excel and other software applications;</li> <li>- to fill in any technical documentation;</li> <li>- to execute the order forms;</li> <li>- to keep records and write-off of electronic components and other materials;</li> <li>- to keep logs of briefings, incoming and outgoing documents;</li> <li>- to conduct necessary documentation for the subordinate employees;</li> <li>- to keep all regulatory documentation</li> </ul>	<ul style="list-style-type: none"> <li>- keeping regulatory documentation;</li> <li>- rules of accounting and write-off of materials</li> </ul>	BC 3.1 BC 3.2
<b>For Special Field: <u>Junior electronic engineer</u></b>					



PC 3.1 PC 3.2 PC3.3 PC 4.1 PC 4.2	<b>PM-08 Maintenance of other types of electronic equipment and micro-processor hardware</b>	<ul style="list-style-type: none"> <li>- workplace arrangement for service and maintenance of microprocessor hardware;</li> <li>- safety precautions for maintenance and service of microprocessor hardware;</li> <li>- ESD protection during maintenance;</li> <li>- ecology for maintenance of electronic microprocessor hardware;</li> <li>- methods of installation and connection of various electronic equipment systems;</li> <li>- all kinds of measurements and analysis of electrical circuits;</li> <li>- rules of commissioning and maintenance of electronic equipment;</li> <li>- operation principle of diagrams of all types of electronic equipment</li> <li>- rules and types of assembly and disassembly using infrared soldering stations</li> </ul>	<ul style="list-style-type: none"> <li>- to work with technical literature and catalogs;</li> <li>- to read flow diagrams of all types of electronic equipment;</li> <li>- to work with soldering stations;</li> <li>- to replace microprocessors and chips in electronic equipment;</li> <li>- to manage a team;</li> <li>- to provide objective jobs</li> </ul>	<p>in the application of personal protective equipment</p> <ul style="list-style-type: none"> <li>-to read electrical and flow diagrams of electrical equipment;</li> <li>-to maintain other types of electronic equipment and the microprocessor hardware;</li> <li>- to identify and to troubleshoot satellite other types of electronic equipment and the microprocessor hardware;</li> <li>- to use instrumentation for configuration, adjustment and maintenance of other types of electronic equipment and microprocessor hardware;</li> </ul> <p>in the analysis of conducted performance measurements</p> <ul style="list-style-type: none"> <li>- execution of required reporting documentation;</li> <li>- repair of various kinds of electronic equipment;</li> <li>- to read and compose different diagrams</li> </ul>	BC 4.1 BC 4.2
PC 3.1 PC 3.2 PC3.3 PC 4.1 PC 4.2	<b>PM-09 Management and work flow methods</b>	Objectives and tasks of management of various organizational and legal forms; management functions; internal and external arrangement media; the foundations of the theory of management decision-making;	<ul style="list-style-type: none"> <li>- adoption and implementation of management decisions;</li> <li>- conflict management methods;</li> <li>- peculiarities of management in the field of professional activity;</li> </ul>	<ul style="list-style-type: none"> <li>- to use the methods of business communication in professional activity;</li> <li>- to adopt effective solutions.</li> </ul>	BC 4.1 BC 4.2
PC 3.1 PC 3.2 PC3.3 PC 4.1 PC 4.2	<b>PM-10 Software of electronic equipment</b>	<ul style="list-style-type: none"> <li>the principle of using computer technology;</li> <li>- principle of information coding;</li> <li>- principle of modeling, drafting a text editor.</li> <li>- principle of diagnosing malfunctions of electronic equipment using software;</li> <li>- analysis and synthesis of hardware and software;</li> <li>- all kinds of measurements and analysis of electrical diagrams;</li> <li>- calculations and configuration of various electronic equipment</li> </ul>	<ul style="list-style-type: none"> <li>- to install a certain software system;</li> <li>- to install standard software;</li> <li>- to create a network connection;</li> <li>- to conduct program update independently;</li> <li>- to create a simple technical drawings;</li> <li>- to works with software applications;</li> <li>- web-programming;</li> <li>- error-free diagnostics and repair all kinds of home appliances and cell phones</li> </ul>	<ul style="list-style-type: none"> <li>- to operate with computer;</li> <li>- to reinstall software of electronic equipment;</li> <li>- to update software;</li> <li>- to draw up all necessary accounting and reporting documents</li> </ul>	BC 4.1 BC 4.2
<b>Industrial training and professional internship</b>					
<b>Industrial training</b>					

PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7	<b>Electrical installation work:</b> Electric radio components. Control and measuring devices. Soldering of electrical connections. Installation of stabilized rectifier, symmetrical multivibrator. Installation, measurement of parameters and configuration of audio amplifiers. Installation of integrated circuits. Maintenance and adjustment of audio amplifiers, according to IS. - introduction and repair of combined receivers and devices for magnetic recording and playback. Maintenance and adjustment of television equipment (CRT). Maintenance and adjustment of television equipment using LCD, plasma and LED displays. Maintenance of digital audio-video hardware. Tuning and maintenance of satellite receiving equipment.	DREE (domestic radioelectronic equipment) development prospects. - Safety precautions for service and maintenance of electronic equipment, industrial sanitation and its objectives. - electrical installation work processing. Details and nodes of radio and television equipment. - radio and television equipment miniaturization. - low frequency amplifiers. - devices for magnetic recording and audio signals reproduction. - structural diagram, operating principle, components and their functions; TV in black and white. Structure, operating principle, the components, their purpose, color TV sets using (CRT). - structure, operating principle, the components, their purpose, color TV sets with LCD, plasma and LED displays. - devices for magnetic recording and reproducing video and audio signals. - devices for digital recording and reproducing video and audio signals. - structure, operating principle, the components, their purpose, purpose of satellite receiving equipment	- to use layout tools, to perform various actions with the mechanical parts; - to distinguish the appearance of different types of radio electronic elements, to determine their parameters, to perform the connection; - to compose mounting, flow electric VC diagrams, assembly and testing of the VC efficiency; - to compose mounting, flow electric AFA diagrams, installation and verification of its operation, configuration and measurement of the amplifier's parameters; - to make the layout of radio electronics, printed circuitboard manufacturing, to perform the connection of chips from PCB; - to check the measurement electronic devices; - to switch on, to install and to measure the main electrical parameters; - to disassemble and to assemble the elements and to switch on the electric acoustic transducers; - to carry out the assembly of public address schemes; - to identify and eliminate faults in radio receivers, to adjust; - to use measuring equipment during technical operation of television systems, tape recorders, digital recording of audio and video frequency signals. - to carry out maintenance, tuning and adjustment of satellite receiving equipment.	- - measurement of geometric parameters of details, to perform different types of machining: cutting, clearance, marking, etc; - - electrical installation works using electric solderers to assemble circuits of various devices; - - to carry out the assembly of the stabilized rectifier and multivibrators removing various indicators; - - relief of voltage maps and resistance of audio amplifier; - - to carry out installation of automation systems; - - to check the cables and generators; - - to check electrical installations, assembly of complex circuits of public address systems; - - to perform the installation and configuration of individual nodes of radio receiver; - - to identify and troubleshoot television receivers, setting of home appliances, LCD, plasma and LED displays. The digital recording of audio and video frequency signals. - - to carry out maintenance, tuning and adjusting satellite receiving equipment.	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6
<b>Professional internship</b>					
<b>Introductory training</b>					

PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7	Introductory lesson. Instruction in occupational safety and health. Introduction to enterprise. Operation with metering devices. Work on the production team for the maintenance and service of radio electronic equipment.	electrical work method. Details and nodes of radio and television equipment. - radio and television equipment miniaturization. - low frequency amplifiers. - devices of a magnetic recording and playback of audio frequency signals	- execution and reading of drawings according to USDD; - compliance with safety regulations and labor protection; - selection of electroacoustic transducers; - development of technological instructions, process charts of telecommunication equipment and appliances; - control of safety and protection of worker labor; - monitoring of compliance with the installation work technology.	- prevention, maintenance and repair of telecommunications equipment and household appliances; - tuning and adjustment of electroacoustic transducers; - development of industrial jiggings of telecommunication equipment and household appliances. work as stand-ins in the technical staff for operation of telecommunication equipment and household appliances.	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6
<b>Professional process-oriented internship</b>					
PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7 PC 3.1 PC 3.2 PC 3.3	Introductory lesson. Instruction to occupational safety and health. Introduction to enterprise. Operation with metering devices. Work on the production team for the maintenance and repair of radio electronic equipment. Self-repair and maintenance of electronic equipment	- Safety regulations for service and maintenance of electronic equipment, industrial hygiene and its objectives. - electrical installation work process. Details and nodes of radio and television equipment. - radio and television equipment miniaturization. - low frequency amplifiers. - device of the magnetic recording and reproducing audio signals. - structural diagram, operating principle, components and their functions; TV in black and white. Structure, operating principle, the components, their purpose, color TV sets using (CRT). - structure, operating principle, the components, their purpose, color TV sets with LCD, plasma and LED displays. - devices for magnetic recording and reproducing video and audio signals. - devices for digital recording and reproducing video and audio signals. - structure, operating principle, the components, their purpose, purpose of satellite receiving equipment	to organize the workplace; - to read and to collect electronic circuit technology; - to troubleshoot; - to complete electrical and radio electronic equipment prior to installation; - to make installation in compliance with the technological requirements; - to observe safety precautions.	Assembly of electronic equipment schemes - Control over the configuration; - Troubleshooting and damage to products of radio electronic television equipment, process equipment circuits.	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6
<b>Pre-graduation (trainee) internship</b>					

PC 2.1 PC 2.2 PC 2.3 PC 2.4 PC 2.5 PC 2.6 PC 2.7 PC 4.1 PC 4.2	<p>Introductory lesson. Instruction on occupational safety and health. Operation with metering devices. Work on the production team for the maintenance and repair of electric and radio electronic equipment. Independent service and maintenance of electric, electronic equipment. Commissioning of the products of electronic engineering and high-tech equipment. Software configuration of radioelectronic equipment.</p>	<p>How to determine the types of processors in a variety of REE: in the micro computer IBM</p> <p>How to identify the functionality of the measuring instruments and systems.</p> <p>to use the functions performed by the computing means in measuring instruments and systems</p> <p>methods of how to make the design of microprocessor-based automated measuring systems.</p> <p>- methods of diagnosis efficiency of the equipment of different types of REE and hardware on microprocessor, design techniques</p> <p>- functional measuring instruments and systems</p> <p>- device operation mode management (the sensitivity of the installation, alteration filter bandwidth, etc.); calibration control (zero setting, check the calibration on the electric signals or samples);</p> <p>- Work of various kinds of devices and equipment REE microprocessor.</p> <p>- methods of design of microprocessor automated measuring systems</p>	<p>to arrange the workplace; - to read and to collect radio electronic device diagram; - to troubleshoot; - to complete electronic equipment prior to installation; - to conduct installation in compliance with the technological requirements; - to comply with safety precautions; - to conduct computer diagnostics, tuning and adjustment of the electronic equipment; - to conduct works in a unit under the direction of specialists of higher qualification.</p>	<p>- assembling electronic equipment circuits;</p> <p>- monitoring of the equipment;</p> <p>- troubleshooting and damage electronic technology products, process equipment circuits.</p> <p>- to dismantle and to install of radio equipment.</p> <p>Configuration and adjustment of radio equipment and satellite receiving equipment.</p> <p>- to make computer diagnostics and to repair electronic equipment, to replace processors and chips using a soldering stations</p> <p>- to comply with precautions safety and occupational health, industrial hygiene and fire safety.</p>	BC 2.1 BC 2.2 BC 2.3 BC 2.4 BC 2.5 BC 2.6
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## 6. CONTENT OF EDUCATION PROGRAM (MODULES)

### Basic Modules

#### BM 01. Installation of electronic equipment

*Qualifications: Fitter/ tradesman for maintenance and service of telecommunication and electronic equipment*

*Video surveillance and burglar alarm systems setter*

##### 1.1 Module aim and objective:

This module gives a student an understanding of the installation of electronic devices, scope of application, practical skills for installation works, grasp of instrument, compliance with safety regulations for installation works.

##### 1.2. Overview of the module

This module describes the performance of work, the skills and knowledge required for setup and installation of electronic equipment. The knowledge and practical skills obtained from this course are used by students during commissioning and installation of electronic equipment and the study of other disciplines. The course content is designed to show the importance of electrical terminology, reading of electrical circuits and the conditions of admission qualifications for the use of electronic equipment. Within the training course, a student gets acquainted with graphic symbols, methods and tools for installation and maintenance of electronic and telecommunication equipment.

##### 1.3. Content of the module

- occupational health and safety;
- reading the drawings and electronic equipment diagrams;
- electrical engineering;
- basics of radioelectronics and radioelectronic devices;
- electric radio measurements;
- special technology.

## Learning outcomes and assessment criteria

Ошибка! Источник ссылки не найден.

BySpecialField: Fettle Tradesman for maintenance and service of electronic equipment

<b>Learning outcomes</b> <b>After successful completion of this module, a student will</b>	<b>Assessment criteria</b> <b>A student must</b>
PO1 <b>know:</b> Safety precautions for installation works.	1.1 evaluate increased level of electromagnetic, X-ray, ultraviolet radiation. 1.2 set the level of particulate air pollution, the uneven distribution of brightness in the field of view. 1.3 identify the causes of fire in educational workshops. 1.4 use primary fire fighting equipment. 1.5 explain the effects of electric current on the body. 1.6 determine the causes of electric shock. 1.7 use means of electrical protection against electric shock. 1.8 provide first aid for electric shock.
PO2 <b>know:</b> Graphic symbols. Technical terms and drawings for installation works.	2.1 graphic symbols. 2.2 technical terms and drawings. 2.3 schematic and installation diagrams. 2.4 graphical conventions of wires and harness. 2.5 graphical conventions of radio elements.
PO3 <b>know and learn:</b> to make the selection of electrical equipment by power for installation works.	3.1 calculation of simple electrical diagrams 3.2 selection of electrical equipment by power. 3.3 electricity laws (Ohm's, Kirchhoff's) 3.4 electric values.
PO4 <b>understand:</b> Processes occurring in radio elements.	4.1 resistors, capacitors, inductors, transformers 4.2 semiconductors. 4.3 processes occurring in the radio elements. 4.4 intrinsic conductivity of semiconductors. 4.5 semiconductor rectifier diodes.
PO5 <b>know:</b> ratings of resistors and capacitors, inductors and transformers.	5.1 determine the ratings of resistors and capacitors. 5.2 inductors and transformers 5.3 evaluate the performance of radio elements, harnesses and communication lines. 5.4 carry out inspections of semiconductor devices. 5.5 analyze the measurements made.
PO6. <b>know:</b> Carry out mechanical and electrical installation of electronic equipment, conduct inspection and installation test	6.1 arrange workplace. 6.2 choose soldering methods, solders and fluxes. 6.3 prepare radio elements and communication lines for assembly. 6.4 make mechanical and electrical installation of electronic equipment. 6.5. carry out control and assembly test.

## **Basic Modules**

### **BM 02. Installation, maintenance, service of commutation devices.**

*Qualifications: Fitter Tradesman for maintenance and service of telecommunication and electronic equipment*

*Video surveillance and burglar alarm systems setter*

**1.1 Module aim and objective:** - This module gives a student an understanding of the installation, service and maintenance of switching devices, scope of application, practical skills for installation, service and maintenance of switching device, grasp of an instrument, safety compliance during the installation, service and maintenance of switching devices.

#### **1.2 Overview of the module**

This module describes the performance of work, the skills and knowledge necessary for the installation, service and maintenance of switching devices. The knowledge and practical skills gained from this course are used by students during the installation, service and maintenance of switching devices, commissioning and installation of electronic equipment and the study of other disciplines. The course content is designed to show the importance of electrical terminology, reading of electrical diagrams and the conditions of admission qualifications for the use of electronic equipment. Within the training course, a student gets acquainted with the graphics, principles of operation, methods of inspection, prevention and control, instruments for installation, service and maintenance of telecommunications and electronic equipment.

#### **1.3. Module content**

- occupational health and safety;
- reading the drawings and electronic equipment diagrams;
- electrical engineering;
- basics of radioelectronics and radioelectronic devices;
- electric radio measurements;
- special technology.



### Learning outcomes and assessment criteria

By qualification: Fitter Tradesman for maintenance and service of telecommunication and electronic equipment

<b>Learning outcomes</b> <b>After successful completion of this module, a student will</b>	<b>Assessment criteria</b> <b>A student must</b>
<b>PO1 know:</b> Safety precautions for installation, service and maintenance of switching devices	1.1 detect violations of switching devices isolation. 1.2 use tools for service and maintenance of switching devices. 1.3 determine the causes of electric shock. 1.4 use protective clothing. 1.5 use means of electrical protection against electric shock.
<b>PO2 know:</b> Graphic symbols of switching devices.	2.1 graphic symbols of switching devices. 2.2 technical terms and drawings of switching devices. 2.3 schematic, installation and flow diagrams.
<b>PO3 know:</b> the design, purpose of switching devices. Requirements for the switching devices.	3.1 Design switching devices 3.2 Select switching devices and electrical equipment by the power. 3.3 Processes in the switching devices 3.4 Requirements to the switching devices. 3.5 Purpose of switching devices.
<b>PO4 know:</b> Closing switches, circuit breakers, circuit changers, seal switches. Relay, group circuit changers.	4.1 Closing switches, circuit breakers, circuit changers, seal switches. 4.2 Relay, group circuit changers. 4.3 Switching principles of relays, closing switches and circuit breakers. 4.4 Connectors and harnesses. 4.5 Plug and un-plug connections.
<b>PO5 know:</b> Types of closing switches, circuit breakers, circuit changers, seal switches. Relay, group circuit changers, measurement rated values.	5.1 Determine the types of closing switches, circuit breakers, circuit changers, seal switches. 5.2 Relay, group circuit changers 5.3 Assess the operation of closing switches, circuit breakers, circuit changers, seal switches. 5.4 Inspect closing switches, circuit breakers, circuit changers, seal switches. 5.5. Analyze the measurements.



<p><b>be able to:</b> organize the workplace, choose soldering methods, installation solders and fluxes, repair and maintenance of switching devices, prepare switching devices. For mounting, make mechanical and electrical installation of switching devices, perform maintenance, inspection and testing of switching devices.</p>	<p>6.1 Organize the workplace.          6.2 Choose soldering methods, installation solders and fluxes, repair and maintenance of switching devices          6.3 Prepare switching devices. for installation.          6.4 Make mechanical and electrical installation of switching devices          6.5. Perform maintenance, inspection and testing of switching devices</p>
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### Basic modules

#### **BM 03. Repair and adjustment of power supplies.**

*Qualifications: Telecommunications and electronic equipment repair and maintenance setter*

*Video surveillance and alarm systems setter*

**1.1 Module aim and objective:** - this module gives the student an understanding of repair and adjustment of power supplies, scope of application, practical skills in repair and adjustment of power supplies, mastering of safety regulations compliance means when repairing and maintaining power supply.

#### **1.2 Overview of the module**

This module describes the work performance, skills and knowledge necessary for the repair and adjustment of power supplies. The knowledge and practical skills gained from this course, are used by the trainees in repairing and adjusting power sources and studying other disciplines. The course content is designed to show the importance of electrical terminology, interpretation of electrical circuits, and the qualification admission conditions for the electronic equipment use. During training the student gets acquainted with the graphic characters, operation principles, tools repair, monitoring and inspection methods when repairing and adjusting power supplies.

#### **1.3. Module content**

- Occupational Health and Safety;
- Interpretation of drawings and electronic equipment circuits;
- Electrical equipment;
- Fundamentals of radioelectronics and radioelectronic devices;
- Electric and radio measurements;
- Special technology.

## Learning outcomes and assessment criteria

*qualification: Telecommunications and electronic equipment repair and maintenance setter*

Learning outcomes After the successful completion of the module, the student will:	Assessment criteria Student:
<b>PO1 know:</b> Safety rules in the repair and adjustment of power supplies.	1.1 detect violations in the isolation of power supplies. 1.2 use tools for repair and maintenance of power supplies. 1.3 determine the causes of electric shock. 1.4 use of special clothes. 1.5 use the protection means against electric shock. 1.6 provide first aid at electric shock 1.7 use primary fire extinguishing means.
<b>PO2 know:</b> Graphic characters of power supplies radioelements. Technical terms, drawings, schematic electrical diagrams of various types of power sources.	2.1 Graphical symbols of power source radioelements. 2.2 Technical terms and drawings of different types of power sources. 2.3 Structure, assembly and schematic electrical diagrams
<b>PO3 know</b> the electric charge. Potential difference. EMF. Power supplies in AC electric circuit. Power supplies in DC electric circuit.	3.1 Electric charge. Potential difference. EMF. 3.2 Power supplies in AC electric circuit . 3.3 Power supplies in DC electric circuit. 3.4 Design of power supplies 3.5 Secondary power supply.
<b>PO4 know</b> transformers, semiconductor rectifiers of power supplies. Stabilizers of power supply voltages. Operation of switch-mode power supply.	4.1 Transformers, semiconductor rectifiers of power supplies. 4.2 Stabilizers of power supply voltages . 4.3 Operation of switch-mode power supply . 4.4 parts and processes in the SMPS. 4.5 Operating voltage of power supplies.
<b>PO5 be able to:</b> determine the serviceability of the power supplies radio elements, evaluate the power supplies operation, receive the data of the individual power supply nodes, use the collected data of power supplies operation. Analyze power supply measurements.	5.1 determine the serviceability of the power supply radio elements. 5.2 check the power supply radio elements . 5.3 receive the data of the individual power supply nodes. 5.4 use the collected data of power supplies operation.. 5.5. analyze power supply measurements

PO6 <b>be able to:</b> organize the workplace, assess the power supply operation, detect the power supply troubleshoot, dismantle and install radio elements, repair and adjust power supplies.	6.1 organize the workplace. 6.2 assess the power supply operation 6.3 detect the power supply troubleshoot. 6.4 dismantle and install radio elements. 6.5. repair and adjust power supplies.
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### **Professional modules**

#### **PM 01. Repair, setting and adjusting of low-frequency amplifiers.**

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

**1.1 Module aim and objective:** - this module gives the student an understanding of the repair, setting and adjustment of low frequency amplifiers, scope of application, practical skills in repair, setting and adjustment of low frequency amplifiers, mastering of safety regulations compliance means when making repair, setting and adjustment of low frequency amplifiers.

#### **1.2 Overview of the module**

This module describes the work performance, skills and knowledge necessary for the the repair, setting and adjustment of low frequency amplifiers. The knowledge and practical skills gained from this course, are used by the trainees in making the repair, setting and adjustment of low frequency amplifiers and studying other disciplines. The course content is designed to show the importance of electrical terminology, interpretation of electrical circuits, and the qualification admission conditions for the electronic equipment use. During training the student gets acquainted with the graphic characters, operation principles, repair, monitoring and inspection methods, tools and devices for setting and adjustment of low frequency amplifiers.

#### **1.3. Module content**

- Occupational Health and Safety;
- Interpretation of drawings and electronic equipment circuits;
- Electrical equipment;
- Fundamentals of radioelectronics and radioelectronic devices;
- Electric and radio measurements;
- Special technology.

## Learning outcomes and assessment criteria

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

<b>Learning outcomes</b> <b>After the successful completion of the module, the student will:</b>	<b>Assessment criteria</b> <b>Student:</b>
<b>PO1 know:</b> Safety rules in repairing and adjusting low frequency amplifiers.	1.1 use tools for repair and maintenance of power supplies. 1.2 detect violations in the isolation of low frequency amplifiers. 1.3 determine the causes of electric shock. 1.4 use special clothes. 1.5 use the protection means against electric shock. 1.6 provide first aid at electric shock 1.7 use primary fire extinguishing means.
<b>PO2 know:</b> Graphic characters of low frequency amplifier radioelements. Technical terms, drawings, schematic electrical diagrams of various types of low frequency amplifiers .	2.1 Graphical symbols of low frequency amplifier radioelements. 2.2 Technical terms and drawings of different types of low frequency amplifier. 2.3 Structure, assembly and schematic electrical diagrams of low frequency amplifier
<b>PO3 know:</b> Low frequency signal sources. Operating range of amplified frequencies. Dynamic range of the amplitudes, rated output voltage, sensitivity, self-noise, random noise, self-excitation of low-frequency amplifiers.	3.1 Low frequency signal sources 3.2 Operating range of amplified frequencies. 3.3 Dynamic range of the amplitudes. 3.4 Rated output voltage . 3.5 Sensitivity, self-noise , $\phi_{OH}$ , self-excitation.
<b>PO4 know</b> the typical circuits of the amplifier stages on bipolar transistors, typical circuits of amplifier stages on field transistors	4.1 Identify the typical circuits of the amplifier stages on bipolar transistors. 4.2 Identify the typical circuits of amplifier stages on field transistors. 4.3 Explain the amplifier stages circuit on operating amplifiers. 4.4 Graphic equaliser circuits. 4.5 Radio elements, transistors, integrated circuits, used in the low-frequency amplifiers.

<p><b>PO5 be able to:</b> Identify the serviceability of the low frequency amplifier radio elements. Check power supply radio elements. Use a measuring technique for the transistors operating modes in the amplifier stage. Use the collected data of the operation frequency characteristics, analyze low frequency amplifier measurements</p>	<p>5.1 Identify the serviceability of the low frequency amplifier radio elements. 5.2 Check power supply radio elements. 5.3 Use a measuring technique for the transistors operating modes in the amplifier stage. 5.4 Use the collected data of the operation frequency characteristics. 5.5. Analyze low frequency amplifier measurements</p>
<p><b>PO6 is able to:</b> Diagnose the operation of low-frequency amplifiers. Evaluate the operation of low-frequency amplifiers. Identify the failure of low frequency amplifiers, dismantle and install radio elements, repair, adjust and set low-frequency amplifiers.</p>	<p>6.1 Diagnose the operation of low-frequency amplifiers. 6.2 Evaluate the operation of low-frequency amplifiers 6.3 Identify the failure of low frequency amplifiers . 6.4 Dismantle and install low-frequency amplifier radio elements. 6.5. Repair and adjust low-frequency amplifiers</p>

### Professional modules

#### **PM 02. Repair, setting and adjusting of magnetic and optical audio and video recording and playback combined devices.**

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

**1.1 Module aim and objective:** - this module gives the student an understanding of the repair, setting and adjustment of magnetic and optical audio and video recording and playback combined devices, scope of application, practical skills in repair, setting and adjustment of magnetic and optical audio and video recording and playback combined devices, mastering of safety regulations compliance means when making repair, setting and adjustment of magnetic and optical audio and video recording and playback combined devices.

#### **1.2 Overview of the module**

This module describes the work performance, skills and knowledge necessary for the the repair, setting and adjustment. The knowledge and practical skills gained from this course, are used by the trainees in making the repair, setting and adjustment of magnetic and optical audio and video recording and playback combined devices and studying other disciplines. The course content is designed to show the importance of electrical terminology, interpretation of electrical circuits, and the qualification admission conditions for the electronic equipment use. During training the student gets acquainted with the graphic characters, operation principles, repair, monitoring and inspection methods, tools

and devices for setting and adjustment of magnetic and optical audio and video recording and playback combined devices.

### 1.3. Module content

- Occupational Health and Safety;
- Interpretation of drawings and electronic equipment circuits;
- Electrical equipment;
- Fundamentals of radioelectronics and radioelectronic devices;
- Electric and radio measurements;
- Special technology.

#### Learning outcomes and assessment criteria

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

<b>Learning outcomes</b> <b>After the successful completion of the module, the student will:</b>	<b>Assessment criteria</b> <b>Student:</b>
<b>PO1 know:</b> Safety rules in repairing and adjusting magnetic and optical audio and video recording and playback combined devices.	1.1 detect violations in the isolation of magnetic and optical recording and playback combined devices. 1.2 use tools for repair and maintenance of magnetic and optical recording and playback combined devices. 1.3 determine the causes of electric shock. 1.4 use special clothes. 1.5 use the protection means against electric shock. 1.6 provide first aid at electric shock 1.7 use primary fire extinguishing means.
<b>PO2 know:</b> Graphic characters of radioelements of magnetic and optical audio and video recording and playback combined devices. Technical terms, drawings, structural, installation and schematic electrical diagrams of different types of magnetic and optical audio and video recording and playback combined devices.	2.1 Graphical symbols of radioelements of magnetic and optical audio and video recording and playback combined devices. 2.2 Technical terms and drawings of different types of different types of magnetic and optical audio and video recording and playback combined devices. 2.3 Structural, installation and schematic electrical diagrams of different types of magnetic and optical audio and video recording and playback combined devices



<p><b>PO3 know:</b> Sources of radio frequency signals Sensitivity of the radio receiver. Operating range of amplified frequencies. Helical optical recording principle. Automatic control system. Principle of optical audio and video recording and playback.</p>	<p>3.1 Sources of radio frequency signals 3.2 Sensitivity of the radio receiver 3.3 Magnetic audio recording and playback. 3.4 Principle of helical optical recording and playback with two video signal rotating heads 3.5 Automatic control system. 3.6 Principle of optical audio and video recording and playback.</p>
<p><b>PO4 know:</b> the principle of audio and video signals recording and playback. Radioelements, transistors, integrated circuits, devices used in magnetic and optical audio and video signal recording and playback.</p>	<p>4.1 Identify the typical circuits of universal amplifiers. 4.2 Identify the typical circuits of erasing and biasing generators. 4.3 principle of audio and video signals recording and playback. 4.4 Receive and handle ACS signals. 4.5 Radioelements, transistors, integrated circuits, devices used in magnetic and optical audio and video signal recording and playback.</p>
<p><b>PO5 be able to:</b> use the collected data of the operation frequency characteristics, analyze the measurements in the repair and adjustment of magnetic and optical recording and playback combined devices.</p>	<p>5.1 Determine the serviceability of magnetic and optical recording and playback combined devices nodes. 5.2 Check radio elements of magnetic and optical recording and playback combined devices. 5.3 Use a measuring technique for the magnetic and optical recording and playback combined devices operating modes. 5.4 Use the collected data of the operation frequency characteristics. 5.5. Analyze the measurements in the repair and adjustment of magnetic and optical recording and playback combined devices.</p>

<p><b>PO6 is able to:</b> Diagnose the magnetic and optical recording and playback combined devices operation, evaluate the magnetic and optical recording and playback combined devices operation. Identify the troubleshoot and repair the magnetic and optical recording and playback combined devices, dismantle and install radioelements of the magnetic and optical recording and playback combined devices.</p>	<p>6.1 Diagnose the magnetic and optical recording and playback combined devices operation.          6.2 Evaluate the magnetic and optical recording and playback combined devices operation.          6.3 Identify the trouble shoot and repair the magnetic and optical recording and playback combined devices.          6.4 Dismantle and install radioelements of the magnetic and optical recording and playback combined devices.          6.5. Repair and adjust the magnetic and optical recording and playback combined devices.</p>
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### Professional modules

#### **PM 03. Repair, setting and adjusting of the EBT, liquid-crystal, plasma and LED panel television equipments.**

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

**1.1 Module aim and objective:** - this module gives the student an understanding of the repair, setting and adjustment of television equipments, scope of application, practical skills in repair, setting and adjustment of television equipments, mastering of safety regulations compliance means when making repair, setting and adjustment of EBT, liquid-crystal, plasma and LED panel television equipments.

#### **1.2 Overview of the module**

This module describes the work performance, skills and knowledge necessary for the the repair, setting and adjustment of television equipments.

The knowledge and practical skills gained from this course, are used by the trainees in making the repair, setting and adjustment of television equipments.

The course content is designed to show the importance of electrical terminology, interpretation of electrical circuits, and the qualification admission conditions for the electronic equipment use. During training the student gets acquainted with the graphic characters, operation principles, repair, monitoring and inspection methods, tools and devices for television equipments setting and adjustment.



### 1.3. Module content

- Occupational Health and Safety;
- Interpretation of drawings and electronic equipment circuits;
- Television;
- Fundamentals of radioelectronics and radioelectronic devices;
- Electric and radio measurements;
- Special technology.

### Learning outcomes and assessment criteria

*Qualification: Telecommunications and electronic equipment repair and maintenance setter*

<b>Learning outcomes</b> <b>After the successful completion of the module, the student will:</b>	<b>Assessment criteria</b> <b>Student:</b>
PO1 <b>know:</b> Safety rules in repairing and adjusting television equipments.	1.1 detect violations in the television equipments isolation. 1.2 use tools for repair and maintenance of television equipments. 1.3 determine the causes of electric shock. 1.4 use special clothes. 1.5 use the protection means against electric shock. 1.6 provide first aid at electric shock 1.7 use primary fire extinguishing means.
PO2 <b>know:</b> Graphic characters of television equipment radioelements. Technical terms, drawings, structural, installation and schematic electrical diagrams of different types of television equipments.	2.1 Graphic characters of television equipment radioelements. 2.2 Technical terms and drawings of different types of television equipments. 2.3 Structural, installation and schematic electrical diagrams of television equipments.
PO3 <b>know:</b> Physical fundamentals of television. Generate the color television video signals. Scanners. Synchronize the scanners. Impulse generators. Properties and characteristics of the television signal	3.1 Sources of television signals. 3.2 Evaluate the television receiver video quality. 3.3 Adjust the television receiver. 3.4 Principle of generating a color television video signal. 3.5 Principle of forming the scanner voltage. 3.6 Identify functionalities of color TV sets.

<p><b>PO4 know:</b> the generating of the EBT color video, generating of the LET display color video.</p> <p>Radioelements, transistors, integrated circuits used in the television equipment.</p> <p>Typical circuit of the television equipment and circuits of framing and horizontal deflection generators.</p>	<p>4.1 Identify the typical circuit of the television equipment.</p> <p>4.2 Identify the typical circuit of framing and horizontal deflection generators.</p> <p>4.3 Generating of the EBT color video.</p> <p>4.4 Generating of the LET display color video.</p> <p>4.5 Radioelements, transistors, integrated circuits used in the television equipment.</p>
<p><b>PO5 be able to:</b> use the collected data of the operation frequency characteristics, analyze the measurements in the repair and adjustment of television equipments.</p>	<p>5.1 Determine the serviceability of television equipment nodes.</p> <p>5.2 Check radio elements of television equipments.</p> <p>5.3 Use a measuring technique for the television equipments operating modes.</p> <p>5.4 Use the collected data of the operation frequency characteristics.</p> <p>5.5. Analyze the television equipments measurements.</p>
<p><b>PO6 be able to:</b> Diagnose the television equipments operation. Evaluate the television equipments operation. Identify the television equipments troubleshoot and operation, dismantle and install television equipment operation radioelements.</p>	<p>6.1 Diagnose the television equipments operation.</p> <p>6.2 Evaluate the television equipments operation.</p> <p>6.3 Identify the television equipment nodes and units troubleshoot.</p> <p>6.4 Dismantle and install television equipment operation radioelements.</p> <p>6.5. Repair and adjust the television equipment.</p>

### **Professional modules**

#### **PM-04 Module «Repair of a digital audio and video recording equipment»**

*Qualification*

*Electronic Technician*

#### **Aim and objective**

This module gives the student knowledge on digital audio and video recording equipment repair.

#### **Introduction to the module**

This module gives the student an understanding of the repair, setting and adjustment of a digital audio and video recording equipment, scope of application, practical skills in repair, setting and adjustment of digital audio and video recording equipment, mastering of safety regulations compliance means

when making repair, setting and adjustment of digital audio and video recording equipment.

The module is suitable to students engaged in the repair, adjustment and setting of digital audio and video recording equipment, maintenance of adjusting devices and facilities used in the repair of digital audio and video recording equipment. The module covers a range of materials and issues with some of them, students may be unfamiliar initially.

This module will allow students to identify and describe the structure and operation of the digital audio and video recording equipment, their technical and electrical characteristics; to know the scope of application and operation ways, to classify them according to their purpose.

Students will apply their understanding of the physical, mechanical and electrical properties of the conductor and semiconductor materials, dielectrics, design requirements, cost, availability of and compliance with electrical equipment during repairing, adjusting and setting the digital audio and video recording equipment.

All electrical equipments have a limit beyond which they can not meet the requirements imposed on them. Common failure modes will be shown and described that allow students to recognize in the future processes occurring in them and causing their breakage where informed choices of used electrical equipment can play a crucial role in the process of repair, adjustment and setting of digital audio and video recording equipment.

In the course of industrial training it is provided to master the skills of working with tools, adjusting devices and facilities used when setting up, repairing and operating digital audio and video recording equipment. The safety methods in the operation, adjustment, repair. Setting, repair and operation methods of digital audio and video recording equipment.

### **Learning outcomes:**

Upon completion of this module, students should:

1. Know the safety rules in the repair, adjustment, setting and operation of digital audio and video recording equipment.
2. Know the structure of the radioelements used in the construction of digital audio and video recording equipment, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.
3. Structure of construction, operation and classification of the digital audio and video recording equipment.
4. Be able to use an instrumentation and control at fault detection, control and adjusting of the digital audio and video recording equipment.
5. Be able to repair and adjust the digital audio and video recording equipment.

## **Module content**

### **1. Know the safety rules in the repair, adjustment, setting and operation of digital audio and video recording equipment**

Electrical safety: the effect of electric current on the human body: the thermal, electrolytic and biological. Local (electrical accident) or general (electric shock).

Three degrees of electric shock:

1. Threshold sensible current.
2. Threshold freezing current
3. Threshold fibrillation current.

The main causes of electric shock.

The use of technical means and protection methods, organizational and technical measures.

Fire safety: The main causes of fires.

Primary fire extinguishing means. Procedure in case of fire. Evacuation plan in case of fire.

### **2. Know the structure of the radioelements used in the construction of digital audio and video recording equipment, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.**

Physical properties of radio materials. Basic properties of dielectrics: dielectric materials, organic polymers, ceramic dielectric materials. Mica and mica materials.

Conductor materials: basic parameters of the conductors, high conductivity materials, superconductors, high-resistance materials, contact materials, solders for soldering.

Semiconductor materials: basic parameters of semiconductors, intrinsic and extrinsic semiconductors, main effects in semiconductors and their application, simple semiconductors, semiconductor chemicals, semiconductor systems.

Magnetic materials: parameters of magnetic materials, magnetization curve of ferromagnetic materials, high-permeability, hard-magnetic materials.

Dispersion-strengthened composite materials, fiber composite materials, non-metal based composite materials, metal based composite materials.

### **3. Structure of construction, operation and classification of the digital audio and video recording equipment.**

Purpose and application in control and automation systems: bipolar and field transistors, thyristors, components of electronic circuits in micro-miniature design.

Optoelectronics components and information display facilities: general

information about the optoelectronics components, controlled light sources, photodetectors, optical fibers and simple optocouplers, liquid crystal information display devices, gas-filled information display devices, semiconductor and electroluminescent information display devices.

Electrical signal amplifiers: Electrical signal amplifiers, their basic parameters and characteristics, feedback theory applied to amplifiers, amplifiers with bipolar and field transistors, high-power amplifier stages, multistage amplifiers, integrated design amplifiers, parameters and characteristics of operating amplifiers, amplifier stability and their correction characteristics.

Electrical signal analog converters: integrating and differentiating devices, active filters, electrical signal magnetoelectron converters, signals and devices multiplier performing mathematical operations, electrical signal detectors.

Electronic keys: information on pulses, processes and devices, diode keys, bipolar and field transistor keys.

Logic elements, triggers, self-oscillators: information about the logic elements, triggers, asymmetrical triggers, oscillation generators.

#### **4. Be able to use an instrumentation and control at fault detection, control and adjusting of the digital audio and video recording equipment.**

Determine the polarity and voltage in electronic units and circuits with the instrumentation and control: voltage measurement, fault in the electrical circuit, the point taken as the reference potential, determines the polarity and voltage.

System troubleshooting search in pulse and digital circuits: voltage in digital circuits, effect of possible short circuits and internal disconnection, systematic error search in the digital circuit, errors in digital integrated circuits.

#### **5. Be able to repair and adjust the digital audio and video recording equipment.**

Diagnose the operation performance of the digital audio and video recording equipment with a control and measuring equipment:

Check the battery power supply, supply voltage converters, magtape handler and video heads crystals, control buttons, control board, display, switching devices for connection to external media, channels of converting the analog signal into digital.

Clean and maintain the digital audio and video recording equipment with special tools.

Repair and maintain the battery and supply voltage adapter.

Repair, adjust and maintain the MTH and video heads crystals.

Repair and replace the display.

Repair and replace the control buttons, control board.

Repair and replace devices to connect to external media.

Check and replace tails and connectors to them.

Inspect and maintain channels of converting the analog signal into digital.  
Clean and repair the lens.

The safety during repairing the digital audio and video recording equipment.

<b>Learning outcomes</b> <b>After the successful completion of the module, the student will:</b>	<b>Assessment criteria</b> <b>Student:</b>
PO1 <b>know:</b> Safety rules in repairing, maintaining, adjusting, setting and operating the digital audio and video recording equipment.	1.1 Determines the electric shock degree. 1.2 Knows how to use technical means and methods of protection against electric shock. 1.3 Choose extinguishing media
PO2 Know the structure of the radioelements used in the construction of digital audio and video recording equipment, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.	2.1 Use dielectric materials. 2.2 Determine the main parameters of the conductors 2.3 Choose the semiconductor materials 2.4 Use dispersion-strengthened composite materials
PO3 Know the structure of construction, operation and classification of the digital audio and video recording equipment.	3.1 Use optoelectronics components and information display facilities 3.2 Fit up electric signal amplifiers 3.3 Use electrical signal analog converters 3.4 Use logic elements, triggers, self-oscillators
PO4 be able to use an instrumentation and control at fault detection, control and adjusting of the digital audio and video recording equipment.	4.1. Determine the polarity and voltage in electronic units and circuits with the instrumentation and control 4.2. Make system troubleshooting search in pulse and digital circuits 1.3. Make systematic error search in the digital circuit, errors in digital integrated circuits
PO5 be able to repair and adjust the digital audio and video recording equipment.	5.1. Diagnose the operation performance of the digital audio and video recording equipment 5.2 Identify causes of the repaired digital devices fault. 5.3 Clean and maintain the digital audio and video recording equipment with special tools 5.4 Repair, adjust and maintain the digital equipment



## **Professional modules**

### **PM 05. Repair of the satellite reception and transmission equipment**

*Qualification*

*Electronic Technician*

#### **Aim and objective**

This module gives the student knowledge on the repair, installation and adjustment of the satellite reception and transmission equipment.

#### **Introduction to the module**

This module gives the student an understanding of the repair, setting and adjustment of satellite reception and transmission equipment, scope of application, practical skills in the repair, setting and adjustment of satellite reception and transmission equipment, mastering of safety regulations compliance means when making the repair, setting and adjustment of satellite reception and transmission equipment.

The module is suitable to students engaged in the repair, adjustment and setting of satellite reception and transmission equipment, maintenance of adjusting devices and facilities used in the repair of satellite reception and transmission equipment. The module covers a range of materials and issues with some of them, students may be unfamiliar initially.

This module will allow students to identify and describe the structure and operation of the satellite reception and transmission equipment, its technical and electrical characteristics; to know the scope of application and operation ways, to classify them according to their purpose.

Students will apply their understanding of the physical, mechanical and electrical properties of the conductor and semiconductor materials, dielectrics, design requirements, cost, availability of and compliance with electrical equipment during repairing, adjusting and setting the satellite reception and transmission equipment.

All electrical equipments have a limit beyond which they can not meet the requirements imposed on them. Common failure modes will be shown and described that allow students to recognize in the future processes occurring in them and causing their breakage where informed choices of used electrical equipment can play a crucial role in the process of repair, adjustment and setting of satellite reception and transmission equipment.

In the course of industrial training it is provided to master the skills of working with tools, adjusting devices and facilities used when setting up, repairing and operating satellite reception and transmission equipments. The safety methods in the operation, adjustment, repair. Setting, repair and operation methods of satellite reception and transmission equipment.

#### **Learning outcomes:**

Upon completion of this module, students should:



6. Know the safety rules in the repair, adjustment, setting and operation of satellite reception and transmission equipment.
7. Know the structure and properties of materials, metals, radioelements, used in the installation, assembly and construction of satellite reception and transmission equipments, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.
8. Structure of construction, operation and classification of the satellite reception and transmission equipment.
9. Be able to use an instrumentation and control at fault detection, control and adjusting of the satellite reception and transmission equipment.
10. Be able to repair and adjust the satellite reception and transmission equipment.

### **Module content.**

#### **1. Know the safety rules in the repair, adjustment, setting and operation of satellite reception and transmission equipment**

Safety in the fitting-mechanical and repair works during the satellite equipment installation and assembly.

Safety in the fitting-mechanical works at height.

Electrical safety: the effect of electric current on the human body: the thermal, electrolytic and biological.

The main causes of electric shock.

The use of technical means and protection methods, organizational and technical measures.

Fire safety: The main causes of fires.

Primary fire extinguishing means. Procedure in case of fire. Evacuation plan in case of fire.

First aid at electric shock.

#### **2. Know the structure and properties of materials, metals, radioelements, used in the installation, assembly and construction of satellite reception and transmission equipments, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.**

Structure and properties of metals; specific resistivity; permeability; dielectric constant; rigidity; strength; ductility; plasticity; elasticity; fragility and density.

Basic properties of dielectrics: insulating materials, organic polymers, ceramic dielectric materials. Mica and mica materials.

Conductor materials: physical properties, purpose and application of coaxial symmetrical cables, markings, basic parameters, fiber optic cable, purpose, application, device used for installation of fiber optic cable, solder for soldering.

Contact materials and devices: matching devices, contact sockets,

connectors, splitters, electrical signal amplifiers, switches.

### **3. Structure of construction, operation and classification of the satellite reception and transmission equipment.**

Types of orbits, satellite's motion, various television broadcasting satellites.

Satellite television broadcasting band.

Parameters of satellite television signals, polarization.

Various types of satellite antennas, converters, analog and digital TV broadcasting systems.

Satellite signal reception device: IF amplifiers, self-mixing oscillator, concentrated selection filter, amplification automatic control device, synchronous phase detector, video path, sound path, control unit, power supply.

Remote Control.

### **4. Be able to use an instrumentation and control at fault detection, control and adjusting of the satellite reception and transmission equipment.**

Determine the polarity and voltage in electronic units and circuits with instrumentation and control: voltage measurement, fault in the electrical circuit, inspection of radioelements.

Devices for determining the satellite signal level with digital and blade indicators.

Device for fine-tuning the satellite antenna to the satellite.

### **5 Be able to repair and adjust the satellite reception and transmission equipment.**

Diagnose the operation performance of the satellite reception and transmission equipment with a control and measuring equipment:

Check the power supply, converter power, control unit, control buttons, switching devices for connecting to external media, channel of converting the analog signal into a digital, signal processing channel, video and sound path.

Assemble the satellite antenna, installation and its mounting, fitting and wiring of coaxial cable, installation of the converter.

Set the satellite antenna to the appropriate satellite.

Set the satellite signal receiving device (receiver).

Repair and replace the control buttons, control units.

Repair and replace devices to connect to external media.

Check and replace tails and connectors to them.

Inspect and maintain channels of converting the analog signal into digital.

Repair the power supply.

Safety in the installation and maintenance works during the installation and maintenance of satellite reception and transmission equipment.

<b>Learning outcomes</b> <b>After the successful completion of the module, the student:</b>	<b>Assessment criteria</b> <b>Student:</b>
<b>PO1 Knows:</b> Safety rules in repairing, maintaining, adjusting and fitting the satellite reception and transmission equipment.	1.1 Comply with safety measures in fitting-mechanical and repair works during the satellite equipment installation and assembly. 1.2 Determines the electric shock degree. 1.3 Knows how to use technical means and methods of protection against electric shock. 1.4 Choose extinguishing media
<b>PO2</b> Knows the structure of materials and radioelements used in the construction of satellite reception and transmission equipment, their electrical, magnetic, thermal, mechanical and physico-chemical characteristics.	2.1 determine the structure and properties of metals. 2.2 evaluate the dielectrics properties 2.3 choose the conductor material 2.4 use contact materials and devices.
<b>PO3</b> Knows the satellite reception and transmission equipment structure and operation.	3.1 select the satellite television broadcasting band 3.2 determine the parameters of satellite television signals 3.3 evaluate the operation of satellite signal reception devices 3.4 use various types of satellite antennas.
<b>PO4</b> Is able to use an instrumentation and control at fault detection, control and adjusting of the satellite reception and transmission equipment.	1.1. Determine the polarity and voltage in electronic units and circuits 1.2. Use devices for determining the satellite signal level 1.3. Use the device for fine-tuning the satellite antenna to the satellite
<b>PO5</b> Is able to repair, set, adjust the satellite reception and transmission equipment.	5.1 Diagnose operation performance of the satellite reception and transmission equipment. 5.2 Assemble the satellite antenna. 5.3 Install the satellite antenna and equipment. 5.4 Set the satellite equipment. 5.5 Maintain and repair the satellite equipment.

## **PM-06 Module “Repair of electronic installation with new equipment”**

### **Aim and objective**

This module gives the student knowledge on the repair of electronic installation with new equipment.

### **Introduction to the module**

This module gives the student an understanding of the repair, setting and adjustment of electronic installation with new equipment, scope of application, practical skills in the repair, setting and adjustment of electronic installation with new equipment, mastering of safety regulations compliance means when making the repair, setting and adjustment of electronic installation with new equipment.

The module is suitable to students engaged in the repair, adjustment and setting of electronic installation with new equipment, operation of new equipment, maintenance of adjusting devices and facilities used in the repair of electronic installation. The module covers a range of electronic installations and issues with some of them, students may be unfamiliar initially.

This module will allow students to identify and describe the structure and operation of the electronic installation with new equipment, its technical and electrical characteristics; to know the scope of application and operation ways, to classify them according to their purpose.

All electrical equipments have a limit beyond which they can not meet the requirements imposed on them. Common failure modes will be shown and described that allow students to recognize in the future processes occurring in them and causing their breakage where informed choices of used electrical equipment can play a crucial role in the process of repair, adjustment and setting of electronic installation with new equipment.

In the course of industrial training it is provided to master the skills of working with tools, adjusting devices and facilities used when setting up, repairing and operating electronic installation with new equipment. The safety methods in the operation, adjustment, repair. Setting, repair and operation methods of electronic installation with new equipment.

### **Learning outcomes:**

Upon completion of this module, students should:

1. Know the safety rules in the repair, adjustment, setting and operation of electronic installation with new equipment.
2. Know the structure and operation and classification of the electronic installation with new equipment.
3. Be able to repair, set and adjust the electronic installation with new equipment.

### **Module content**

1. Know the safety rules in the maintainance, repair, adjustment,

## **setting and operation of electronic installation with new equipment**

Safety in the mechanical and repair works, during dismantling and installation of multifunctional scan and print devices, and communication devices.

Electrical safety: the effect of electric current on the human body: the thermal, electrolytic and biological.

The main causes of electric shock.

The use of technical means and protection methods, organizational and technical measures when repairing the electronic installation with new equipment.

Fire safety: The main causes of fires at stationary workshops.

Primary fire extinguishing means. Procedure in case of fire. Evacuation plan in case of fire.

First aid at electric shock.

## **2. Know the structure and operation and classification of the electronic installation with new equipment.**

Structure of the mobile telephone communication equipment, base stations, signal reception and transmission, types of signal modulation.

Types and design of communication devices: central control processor, random access memory, display, transceiver, key-operated module, self-generated power supply, battery charger, SIM holder.

Structure of the printing equipment: print engine control unit (PECU), central control unit, remote control unit, power supply, stabilizer units, print engine: paper sensor, print start sensor, laser, duct with toner, drum, developer, PC drum, discharge wire, deflecting mirror, cleaning roller, corona wire, fixing cylinders.

Structure of the scanning equipment: power supply, white light source, reducing lens, analog-to-digital converter (ADC) or switch, charge-coupling device (CCD).

## **3. Be able to repair, set and adjust the electronic installation with new equipment.**

Diagnose the operation performance of the electronic installation with new equipment with a control and measuring equipment:

Check the power supply, self-generated power supply, stabilizer units, battery charger, central control unit, control buttons, switching devices to connect to external media, paper sensor, print start sensor, laser, white light source, analog-to-digital converter (ADC).

Diagnose and replace the self-generated power supply

Diagnose and replace the display.

Diagnose and change the control processor.

Diagnose and change the key-operated module.

Repair the print engine in the printing device.

Check and replace tiles and connectors to them.

Change the duct with toner

Fill the duct with toner.

Check the white light source.

Repair the power supply.

Safety in the repair works during the repair of electronic installation with new equipment.

<b>Learning outcomes</b> <b>After the successful completion of the module, the student will:</b>	<b>Assessment criteria</b> <b>Student:</b>
PO1 Know: Safety rules in repairing, maintaining, adjusting, fitting and operating the electronic installation with new equipment.	1.1 Comply with safety measures in the mechanical and repair works, during dismantling and installation of multifunctional scan and print devices, and communication devices. 1.2 Determines the electric shock degree. 1.3 Is able to use technical means and protection methods, organizational and technical measures when repairing the electronic installation with new equipment. 1.4 Choose fire extinguishing means 1.5 Is able to administer first aid at electric shock.
PO2 Know the structure and operation and classification of the electronic installation with new equipment.	2.1 determine the type and design of communication devices 2.2 install printing equipments. 2.3 assess the operation of scanning equipments.
PO3 be able to repair, set and adjust the electronic installation with new equipment.	3.1 Diagnose the operation performance of the electronic installation with new equipment with a control and measuring equipment 3.2 Check and replace tiles and connectors to them 3.3 Fill the duct with toner. 3.4 Install the duct with toner 3.5 Be able to repair the print engine in the printing device. 3.6 Maintain and repair the electronic installation with new equipment.



## **PM 07. Registration of regulatory documents**

*Qualification*

*Electronic Technician*

**1.1 Module aim and objective** - this module gives the student an understanding of registration of regulatory documents, signing with the customer of the electronic equipment repair and maintenance contract, scope of application, practical skills at registering regulatory documents, mastering of a PC and MicrosoftWord, MicrosoftExcel, MicrosoftPowerPoint applications when registering the regulatory documents.

### **1.2 Overview of the module**

This module describes the work performance, skills and knowledge necessary for registration of regulatory documents. The knowledge and practical skills gained from this course, are used by the trainees: in the receiving, registration and issuing of orders, execution of electronic equipment repair and maintenance contracts, monitoring of the repair progress, reception and analysis of customer's complaints, information support, customer complaints handling, transfer of orders to technical experts, drawing up of a service guarantee, accounting and control of major and working equipment and spare parts.

The course content is designed to show an importance of registration of regulatory documents, execution of electronic equipment repair and maintenance contracts. During training the student gets acquainted with the necessary documentation. Rules of its filling. Keep the log book at all levels and in all positions.

Thus students acquire theoretical and practical knowledge aimed at the development of practical skills for the design of regulatory documentsю

### **1.3. Module content**

- Occupational Health and Safety;
- Basics of informatics and automation;
- Paperwork in state language;
- Fundamentals of standardization, certification and metrology;
- Special technology

Ошибка! Источник ссылки не найден.**Learning outcomes and assessment criteria**

*in qualification: Electronics Technician*



<b>Learning outcomes after successful completion of this module</b> <b>The student will</b>	<b>Assessment criteria</b> <b>The student should</b>
PO1 know the rules of registration of normative documents,	1.1 carry out safety measures for equipment acceptance. 1.2. identify the degree of equipment failure. 1.3. be able to issue normative documentation for acceptance equipment. 1.4 carry out information and reference support 1.5 explain the situation to the reception and analysis of the claims
PO2 know the rules of contracting with the customer for the repair and maintenance of electronic equipment.	2.1 determine the type and design of electronics devices. 2.2 choose the type of contract for the repair and maintenance of electronic equipment. 2.3 receive information about the state of the electronic device in communication with the customer. 2.4 carry out control over the progress of the repair
PO3 know the accounting and control of fixed and working equipment and spare parts.	3.1 transmit orders to technical experts group 3.2 be able to maintain control and accounting logs 3.3 collect data about the structure and purpose of the electronic equipment. 3.4 conduct accounting and control of fixed and working equipment. 3.5 be able to keep records in the state language.

## **IIM-08 Module “Repair of other types of electronic equipment and the equipment on microprocessor”**

*Qualification      Junior Electrical Engineer*

### **Module aim and objective**

This module will give students the opportunity to obtain knowledge of operation, maintenance and repair of various types of the electronic equipment and equipment on microprocessor.

### **Introduction to module**

This module will give students an understanding of operation, maintenance and repair of various types of electrical equipment and equipment on microprocessor; application of practical skills when performing maintenance and

repair of various types of electrical equipment and equipment on microprocessor, possession of instrument, compliance with safety regulations when performing maintenance and repair of various types of electrical equipment and equipment on microprocessor.

The module is suitable to students engaged in the design of microprocessor-based automated measurement systems, as well as the operation, maintenance and repair of various types of electrical equipment and equipment on microprocessor. The module covers a range of technologies and issues with some of which students may be unfamiliar initially.

This module will enable students to identify and describe the structure and operation of various types of electrical equipment and equipment on microprocessor, its technical and electro-cal characteristics; to know the scope and ways of operation, to classify them according to their purpose.

In the course of industrial training it is provided to master the skills of working with tools, instruments, equipment and technical means used in the operation, maintenance and repair of various types of equipment and equipment on microprocessor, the methods of safety in the operation, maintenance, adjustment, and repair, the methodology for setting, repair, operation, maintenance of various types of equipment and equipment on microprocessor.

### **Learning outcomes:**

Upon completion of this module, students should:

1. Know the safety precautions in the repair, adjustment, operation and maintenance of various types of electrical equipment and equipment on microprocessor.
2. Know the structure of construction, operation and classification of different types of electrical equipment and equipment on microprocessor.
3. Be able to perform maintenance, and operation of various types of electrical equipment and equipment on microprocessor, and design techniques.

### **Module content**

#### **1. Know the safety precautions in the repair, adjustment, operation and maintenance of various types of electrical equipment and equipment on microprocessor.**

Safety during repair work, in the course of repair, setup, maintenance of various types of electrical equipment and equipment on microprocessor.

Harmful and hazardous production factors in the performance of maintenance, adjustment, maintenance of various types of electrical equipment and equipment on microprocessor: physical, chemical, physiological, electromagnetic, electrostatic, and ultrasonic.

Electrical safety: the impact of electric current on the human body.

Using technical means and methods of protection during installation, repair, adjustment, maintenance of various types of electrical equipment and equipment on microprocessor.

Fire safety: The main causes of fires.

Primary fire extinguishing means. Procedure in case of fire. An evacuation plan in case of fire.

First aid at electric shock.

## **2. Know the structure of construction, operation and classification of different types of electrical equipment and equipment on microprocessor.**

The use, purpose, and types of microprocessors in various types of electrical equipment: in the micro electronic computers - to create automated portable devices, to create automated and fully automated measuring systems and installations.

The use of microprocessors and micro electronic computers allows to successfully performing the following tasks:

- To extend the functional opportunities of measuring instruments and systems. This is achieved simply by switching modes and measurement algorithms with the help of a microprocessor system by programs recorded in the system's memory.
- Reduce the time to set-up and calibrate the instruments. Setup and calibration is carried out automatically before starting. It is possible to automatically implement the mode "self-education" in a series of samples and selection of the optimal measurement algorithm and operation mode of the instrument.
- Increase the measurement reliability due to self-diagnosis and elimination of operator error when setting up and calibrating.
- Improve the measurement accuracy through the use of sophisticated data processing algorithms, which are difficult implemented in conventional devices.
- Improve performance measurement. Separate counts are carried out automatically by the appliance, stored and processed. The operator receives the measurement results in generalized form (e.g., as an average over a certain period of time) or the parameters are displayed outside the allowable limits. This frees the operator from routine operations to record and analyze the results.
- Afford an opportunity for a low qualification staff to operate with the device, as control of the device operation and analysis of results are automated.
- Reduce the cost of development of new devices. Schematic diagrams of devices for different purposes are unified, and the difference in the functioning of the algorithms is provided by software.

The functions performed by computational means in measuring instruments and systems are very diverse. They can be divided into two groups:

- Function of information processing from primary converters: the implementation of basic algorithms (solution of systems of equations, differentiation and integration, filtering, convolution, image processing, etc.), statistical data processing (calculation of averages, histograms);
- Control function: -control device operation mode (sensitivity setting, filter bandwidth alteration, etc.);
- Calibration control (zero setting, check the calibration on the electric signals or samples);
- Self-test (test device functionality, fault detection);
- Control of external devices (indicators, scanning systems);
- Design of microprocessor-based automated measurement systems: the essence of the design process: objectives, method, algorithm, structure, detail, analysis and adjustment, implementation, implementation.

### **3. Be able to perform maintenance, and operation of various types of electrical equipment and equipment on microprocessor, and design techniques.**

To perform diagnostics of various types of electrical equipment and equipment on microprocessor functionality, and design techniques;

To apply microprocessors in the micro electrical computer;

To extend the functionality of measuring devices and systems: data processing from primary converters: the implementation of basic algorithms (solution of systems of equations, differentiation and integration, filtering, convolution, image processing, etc.), statistical data processing (calculation of averages, histograms).

Perform the device operation mode control (sensitivity setting, filter bandwidth alteration, etc.); Calibration control (zero setting, check the calibration on the electric signals or samples); to be able to safely perform maintenance and operation of various types of electrical equipment and equipment in microprocessor, and design methods.

<b>Learning outcomes after successful completion of this module The student will</b>	<b>Assessment criteria The student should</b>
<p>PO1 Know the safety precautions for maintenance, repair, adjustment, operation and design of various types of electrical equipment and equipment on microprocessor.</p>	<p>1.1 carry out safety precautions when performing maintenance, in the process of repair, setup, maintenance of various types of electrical equipment and equipment on microprocessor. 1.2 determine the harmful and dangerous production factors in the performance of repair, configuration, maintenance of various types of electrical equipment and equipment on microprocessor: 1.3 determine the degree of risk of electric shock. 1.4 be able to use technical means and methods of protection against electric shock. 1.5 carry out selection of fire extinguishers 1.6 explain the procedures in case of fire. An evacuation plan in case of fire. 1.7 be able to provide first aid at electric shock.</p>
<p>PO2 Know the structure of the construction, operation and classification of different types of electrical equipment and equipment on microprocessor and design techniques.</p>	<p>2.1 determine the types of processors in a variety of electrical equipment: in the micro electrical computer 2.2 identify the functionality of the measuring instruments and systems. 2.3 use the functions performed by computational means in measuring instruments and systems 2.4 make the design of microprocessor-based automated measuring systems.</p>
<p>PO3 be able to perform maintenance, and operation of various types of electrical equipment and equipment on microprocessor and design techniques.</p>	<p>3.1 choose the methods of diagnosis of performance of different types of electrical equipment and equipment on microprocessor, and design techniques 3.2 explain the functionality of the measuring instruments and systems 3.3 carry out the device operation mode control (setup the sensitivity, filter bandwidth alteration, etc.); calibration control (zero setting, check the calibration on the electric signals or samples); 3.4 evaluate the performance of different types of electrical equipment and equipment on microprocessor. 3.5 use methods for design of microprocessor-based automated measuring systems.</p>

## **IIIM.09 Module «Methods for control and organization of workflows»**

*Qualification Junior Electrical Engineer*

### **Module aim and objective**

This module will give students the opportunity to gain knowledge on the organization of the processes associated with the repair and maintenance of electronic equipment in specialized service centers.

### **Introduction to module**

This module will give students the opportunity to understand modern methods of control and organization of production for maintenance and repair of electronic equipment, organizational structure for innovation process control of the service center.

The module is suitable to students engaged in the management of the service center. The module covers a range of technologies and issues with some of which students may be unfamiliar initially.

This module will enable students to learn the basic directions in the management of innovative projects, the essence of innovation projects, forms and content of innovative projects.

In the course of industrial training it is provided to master skills in service center management.

The types of manufacturing processes. The production structure of the enterprise. The main types of industrial structure, and the service center. The list of services and core activities of the service center: service center is an organization which unites structural, separate divisions that interact with customers when providing services. The customer is physical persons, legal entities, entrepreneurs, concluding a contract with a service center for repair and maintenance of electronic equipment.

Administrator is a person responsible for taking orders, supervising the implementation of the repair. Technical experts group is a structural unit consisting of technicians who are responsible for the immediate repair of electronic equipment. A complaint is a written, oral statement of rights violations directed by the customer to the address of the service center, and its officer. Distance service is a service provided to the customers at home. Consulting is information given to the customer. Reception and Processing Orders Service is a structural unit, which includes a set of hardware, software, personnel, providing repair services to customers, information and reference support, handling customer complaints. Technical Consultant is a person carrying out the coordination of the relationship between the customer and service center.

Submission is a proposal directed by the customer to the address of service center.

Face-to-face service is the provision of services to the customer through



personal contact with the service center staff.

Organization of the maintenance service. Significance of the maintenance service. Subtypes and organization of the maintenance service. The need to the maintenance service. Unified system for planned preventative maintenance (PPM): the nature and content of work for PPM. The types of repairs.

### **Learning outcomes:**

Upon completion of this module, students should:

1. Know the modern methods of management and organization of production for maintenance and repair of electronic equipment. Organizational structures for innovation process management of the service center.
2. Know types of production processes. The production structure of the enterprise. The main types of industrial structure, and the service center. The list of services and major activities of the service center.
3. Know the organization of the maintenance service. Significance of the maintenance service. Subtypes and organization of the maintenance service. The need to the maintenance service. Unified system for planned preventative maintenance (PPM): the nature and content of work for PPM. The types of repairs.

### **Module content**

**1. Know the modern methods of management and organization of production.** The main directions in the management of innovative projects. The essence of innovation projects. Forms and content of innovative projects

Mastering the skills for the management of the service center. The types of production processes.

Safety during the maintenance, in the course of repair, setup, maintenance of various types of electrical equipment and equipment in microprocessor.

**2. The main types of industrial structure, and the service center. The list of services and major activities of the service center.**

The production structure of the enterprise. The main types of industrial structure, and the service center. The list of services and core activities of the service center: service center is an organization which unites structural, separate divisions that interact with customers when providing services. The customer is physical persons, legal entities, entrepreneurs, concluding a contract with a service center for repair and maintenance of electronic equipment.

Administrator is a person responsible for taking orders, supervising the implementation of the repair. Technical experts group is a structural unit consisting of technicians who are responsible for the immediate repair of



electronic equipment. A complaint is a written, oral statement of rights violations directed by the customer to the address of the service center, and its officer.

Distance service is a service provided to the customers at home. Consulting is information given to the customer. Reception and Processing Orders Service is a structural unit, which includes a set of hardware, software, personnel, providing repair services to customers, information and reference support, handling customer complaints. Technical Consultant is a person carrying out the coordination of the relationship between the customer and service center.

Submission is a proposal directed by the customer to the address of service center.

Face-to-face service is the provision of services to the customer through personal contact with the service center staff.

### 3. Know the organization of the maintenance service

The organization of the maintenance service. Significance of the maintenance service. Subtypes and organization of the maintenance service. The need to the maintenance service. Unified system for planned preventative maintenance (PPM): the nature and content of work for PPM. The types of repairs.

<b>Learning outcomes after successful completion of this module</b> <b>The student will</b>	<b>Assessment criteria</b> <b>The student should</b>
PO1 Know the modern methods of management and organization of production.	1.1 choose the main directions in the management of innovative projects. 1.2 evaluate the nature of innovation projects. 1.3 use the skills of the service center management, determine the extent
PO2 Know the main types of industrial structure, and the service center. The list of services and major activities of the service center	2.1 determine the production structure of the enterprise, its types 2.2 determine the main types of industrial structure, and service center 2.3 use a range of services and core activities of the service center, functions
PO3 Know the organization of the maintenance service	3.1 create an organization of the maintenance service 3.2 explain the importance of maintenance services. Subtypes and organization of maintenance service 3.3 perform the planned preventative maintenance (PPM):

## **IIM-10 Module «Software of electronic equipment»**

*Qualification Junior Electrical Engineer*

### **Module aim and objective**

This module will give students the opportunity to gain knowledge about the software that is installed in electronic equipment, types of operating systems and their features, types of configuration and programming of electronic equipment.

### **Introduction to module**

This module will give students an understanding of the structure, classification and features of the personal computers used in the set-up and diagnostics of electronic processes and allow them to choose the ways for troubleshooting and configuration of equipment.

The module is suitable to students engaged in the installation, operation and maintenance of electronic equipment and automation equipment, particularly where the equipment is updated due to software updates. The module covers a number of topics, some of which the students may be unfamiliar initially.

This module will allow students to diagnose and detect malfunctions of electronic devices, their power, and other characteristics; know the scope of use of programmers, and to classify them in accordance with the purpose.

Students will use PCs for repair and diagnostics. Besides the students will work with all applications, install the driver core and peripheral equipment. Create a local network and test their work.

In the course of industrial training it is provided to master the skills of working with a personal computer, providing repair works using a PC and work with applications, creating a local area network, and crimping cables.

### **Learning outcomes:**

Upon completion of this module, students should:

1. Know the personal computer organization.
2. Know the local network.
3. Know the purpose and scope of use of programmers.
4. Software.
5. Be able to install operating systems, applications and drivers
6. Work with applications
7. Produce electronic equipment diagnostics via a PC

### **Module content**

#### **1. The personal computer organization**

Motherboard. Enclosures and installation of the motherboards. Connecting motherboard. Installing and configuring modules and RAM chips. Installation and configuration of the processor. Power and cooling processors. Synchronization.

Acceleration and deceleration of processors. The chipset. BIOS. Power and reset CMOS. BIOS Setup.

Microprocessors and math coprocessors. History of development. Structural microprocessor circuit. Intel COR J7 and other series microprocessors. Intel math coprocessors. Pentium, Pentium IV microprocessors. Processors-clones. Compatibility, identification and comparison of the performance of microprocessors.

System resources. Memory allocation. IO space. Hardware interrupts. Direct Memory Access. Programs interact with peripheral devices. Allocation of system resources. Accessories of motherboard. Keyboard. Manipulators. Digital audio channel. ROM BIOS.

Electronic memory. Dynamic memory. Static memory. Non-volatile memory. Shells and marking of the memory chips.

Cache memory. Cache architecture. The cache memory with direct mapping. Fully associative architecture. Typing and associative architecture. Harvard and Princeton architecture. Cache size. Recording methods. Information update. Cache in processors with frequency multiplying.

Expansion bus.

ISA, EISA, PC-104, MCA buses. VLB local bus. PCI bus. AGP magistral interface. PCMCIA (PC Card) buses.

Video system. Principles of image output. Graphic mode. Text mode. Video processing. BIOS videoservice. Display. Monitor settings. Setting up the monitor. Power management. Ergonomic characteristics. Video display adapters. Memory of the video display adapter. Interfaces of video display adapters. General parameters of the video system.

External memory. Disk drives. Memory on the floppy disk. The memory on the hard disk. Drives with ST-506 and ESDI interfaces. Drives with ATA (IDE) interface. Drives with SCSI interface. Mass storage devices on removable media.

External interfaces. Parallel interface. Serial interfaces. Game Adapter. SCSI bus. USB serial bus. FireWire buses, ACCESS.Bus.

Communication tools. Modems and fax modems. The equipment of local area networks.

Power supply and security of computers. Uninterruptible power supplies. Power source of the system block. Circuitry of power supplies. PC Power Supply.

## **2. Local networks**

Passive LAN equipment. Coaxial cable. "Twisted pair" cable. Fiber optic cable. Connectors. Installation of the cable and connectors.

Active LAN equipment. Network adapters. Hubs and switches. Repeaters. Ethernet technology standards.

CSMA \ CD access method. The formats of Ethernet technology frames. Standard 10 Base - 5. Standard 10 Base - 2. Standard 10 Base - T. Standard 10

Base - F. Standard Token Ring. Main characteristics of Token Ring standard. Arc Net standard. Topology and equipment of Arc Net networks.

Fast Frame Ethernet Standard. Frame formats of Fast Ethernet technology. Specifications physical level of Fast Ethernet technology. The physical level 100 Base - FX. The physical layer 100 Base - TX. The physical layer 100 Base - T4.

Standard FDDI. The history of FDDI standard development. Fundamentals of FD technology

100 VG-100 AnyLan Standard. General characteristic of 100 VG-AnyLan Standard.

Network Operating Systems. Classification of the network operating systems. The structure of the network operating system. Peer network operating systems and operating systems with a dedicated server. Processes and threads in distributed systems.

Modern concepts and operating system design technology. Operating system of Unix family. Network products of Novell firm. Family of network operating systems of Microsoft Company. OS / 2 operating system

Microsoft Windows 2000 operating systems.

Family of Windows 2000 operating systems. Server operating systems of Windows 2000 Server family. Installing and configuring the system. Server Resource Management. Disks and file systems. Distribution of File System. DFS. Print Services. Server Administration. DHCP, DNS, WINS servers.

Data transfer protocols.

TCP / IP Protocol. IPX Protocol. Net BEU Protocol. Apple Talk Protocol.

### **3. Purpose and scope of use of programmers**

Types and purpose of programmers. Error codes in electronic equipment. Information read-out. Methods for updating software in electronic equipment

### **4. Software**

**Apple Mac Os X** Operating System. Program purpose. Scope of use. **Apple Mac Os X** integral parts. Interl commands. External commands.

**Linux. Google Android** Operating Systems and other

**Microsoft Windows**, Windows XP Operating Systems.

The term “operating system”. Purpose of the operating system. Introduction to the Windows XP Operating System. Characteristic. System requirements. Windows XP desktop. Task bar. Main menu. Reference system. “My Computer” and “My Network Places” icons. “Basket”. Context menu. Window. Window Elements. Switch between windows. Standard programs. File system. The terms “file” and “folder”. The structure of the placement of files on the disc. Working with the file system. “Explorer” program.

Archiving Program.

Purpose of archiving programs. Introduction to archiving programs.

WINZIP and WINRAR archiving programs.

Anti-virus programs.

The term “computer virus”. Types of viruses. Purpose and classification of anti-virus programs. DrWeb Anti-virus program and AntiViral Toolkit Pro.

Methods of testing and treatment of files.

Microsoft Word.

Purpose of the program. Toolbars: “Standard”, “Format”, “Drawing”.

Tables. The main menu.

Microsoft Excel. Purpose of the program. Creating and designing tables.

Application of the formulas in tables. The construction of graphs according to the table. Diagramming.

Microsoft PowerPoint. Purpose of the program. Scope of use. Static slides.

Presentations. Using audio in presentations. Animation effects in presentations.

Presentations with the video clips. Using templates of presentations.

Microsoft Access. Scope of use of databases. Basic concepts of database theory. Fields and records. The database structure. Logical expressions. Creating and editing database. Information retrieval. Access Toolbar. Print output. The relational data model

<b>Learning outcomes after successful completion of this module The student will</b>	<b>Assessment criteria The student should</b>
PO1 Know the personal computer organization	1.1 be able to choose microprocessor 1.2 be able to determine and check the motherboard 1.3 select the best option for computer;
PO2 Know the local area network	2.1. be able how to build a local network 2.2 be able to compress the cable 2.3. set up a local area network
PO3 Know the purpose and scope of use of the programmers	3.1 be able to read the electronic device data 3.2 be able to recover software 3.3 be able upon the error code to determine and correct the problem
PO4 Know PC software	4.1 be able to install the operating system 4.2 be able to install the driver 4.3 select the necessary software;
PO5 be able to repair the devices using a PC.	5.1 have skills to work with the programmer 5.2 identify causes of the repaired devices fault 5.3 know the methods for performing repairs using PC

## 7. Syllabus

of technical and vocational, post-secondary education

### Specilty      Maintenance and repair of telecommunication equipment and household appliances (on industries)

Квалификации      Master on repair and maintenance of telecommunication and electronic equipment  
Video surveillance and burglar alarm systems setter  
Electronic technician  
Junior electronic engineer

Mode of study: full-time  
on the basis of general secondary education

**On qualifications:**  
Master on repair and maintenance of telecommunication and electronic equipment  
Video surveillance and burglar alarm systems setter – 1y. 10 m.

**On qualifications:**  
Middle ranking specialist – “Electronic technician” – 2y. 10m.  
“Junior electronic engineer” + 10m.

On the basis of fundamental secondary education  
Total training time with gaining all qualifications is 4 years and 10 months.

Index	Name of modules and practices	Form of as- sessment			Study time volume (hours/credits)				Distribution by semesters
		Examination	Test	Course project / work	TOTAL	Of which:			
						Theoretical classes	Practical education	Industrial training	
1	2	3	4	5	6	7	8	9	10
OM	Compulsory modules								
OOM.00	General modules				1448				1,2
OIM.00	General humanitarian and economical subjects (Professional Kazakh (Russian) Language, Profes- sional Foreign Language, Physical Training, Commu- nication psychology)	1	3		448				1-7
OIIM	General professional modules		7		354				
OIIM.01	Fundamentals of information and automation		+		90	60	30		2,3
OIIM.02	Records management in State Language		+		90	60	30		3-6
OIIM.03	Fundamentals of standardization, certification and me- trology		+		45	30	15		4-7
OIIM.04	Marketing		+		45	30	15		5-8
OIIM.05	Engineering Drawing		+		84	40	44		5-8
	Basic modules				320				



БМ.01	Installation of electronic equipment		+		90	60	30		1
БМ.02	Installation, maintenance and repair of switching devices		+		95	60	35		1,2
БМ.03	Repair and adjustment of power supplies	+			135	90	45		1,2,3
<b>ИИМ</b>	<b>Professional modules</b>								
	<b>Qualification</b> «Master on repair and maintenance of telecommunication and electronic equipment»				<b>320</b>				
ИИМ.01	Repair and adjustment of the low frequency amplifiers		+		90	60	30		3,4,5,
ИИМ.02	Repair and adjustment of the combined devices and devices of magnetic and optical recording and reproducer of sound video tape records		+		90	60	30		3,4,5,6
ИИМ.03	Repair and adjustment of television equipment with CRT, LCD, LED and plasma panels	+			140	90	50		6
	<b>Qualification</b> « Electronic technician»				<b>320</b>				
ИИМ.04	Repair of digital audio and video recording equipment		+		95	60	35		7,8
ИИМ.05	Repair of equipment of satellite reception and transmission		+		95	60	35		7,8
ИИМ.06	Repair of electronic equipment using new equipment	+			95	60	35		7,8
ИИМ.07	Registration of normative documents				45	30	15		8
	<b>Qualification</b> « Junior electronic engineer»				<b>316</b>				
ИИМ.08	Repair of other types of electronic equipment and equipment on microprocessor		+		90	60	30		9,10
ИИМ.09	Methods of control and organization of workflows		+		90	60	30		9,10
ИИМ.10	Software of electronic equipment	+			136	90	46		9,10
<b>МО.00</b>	<b>Modules to be defined by the organization of education</b>				<b>604</b>				

<b>III.00</b>	<b>Industrial Training and Professional Practice</b>						<b>2808</b>			1, 2, 3, 4, 5, 6, 7, 8, 9, 10
II0.01	Industrial training						1332			1, 2, 3, 4, 5, 6, 7, 8
III.02	Introduction practical training						72			2
III.03	Industrial and technological practice						828			4, 6, 8,
III.04	Industrial pre-diploma practice for qualifications						576			8, 10
	Electronic technician						288			8
	Junior electronic engineer						288			10
<b>IIA.00</b>	<b>Interim assessment</b>						<b>180</b>			
<b>IIA.00</b>	<b>Final assessment</b>						<b>72</b>			
IIA.01	Attestation in educational institutions						48			
IIA.02	Assessment of the level of professional training and qualification						24			
	<b>Total for compulsory education</b>						<b>7200</b>			
<b>K</b>	<b>Consultations</b>					no more than 100 hours for the academic year				
<b>Φ</b>	<b>Extra curriculars</b>					not more than 4 hours a week of theoretical training				
	<b>Total:</b>						<b>8100</b>			

***Note:***

- 1) \* practical training include practical (laboratory) work, course papers (projects), tests and other.
- 2) In the development and implementation of job training plans and programs of the organization of technical and vocational education it is possible to:
  - change of up to 30% of the training time devoted to the development of educational material for cycles and up to 30% in each discipline (module) and up to 50% of the production training and professional practice while maintaining the total number of hours for compulsory education;
  - select different training techniques, forms, methods of organization and control of the educational process;
  - in accordance with the needs of employers to change the curriculum content up to 30% in humanities and socio-economic modules and up to 50% on professional modules, production training and professional practice. Introduce additional modules in vocational modules according to employers requirements while maintaining the total number of hours / credits for compulsory education;
  - select the form, procedure and frequency of ongoing monitoring of academic progress of students and intermediate attestation of students enrolled;
- 3) The distribution by courses may vary depending on the learning technologies, the specifics of the specialty, regional features and other specificities.

## **8. Explanatory Note to the curriculum in the specialty 0502000 Maintenance and repair of telecommunications equipment and household appliances (by industry)**

The curriculum reveals the structural content of the training, the amount of teaching time per module, the sequence of study modules.

The teaching process in educational institutions implementing educational programs of technical and vocational, post-secondary education includes theoretical classes and industrial training to be performed in the training workshops, educational farms under the guidance of the Master of vocational training, as well as directly at the production sites and organizations of the appropriate profile.

The amount of training time allocated in the curriculum on the study of **general disciplines** on the basis of general secondary education with general secondary education getting, remains constant in accordance with the CES of the RK for general secondary education.

### **General humanitarian and economic disciplines**

The study of humanitarian disciplines provides to be familiar with the specialty terminology, communication in a state language to work in the field of professional activities.

When developing working curricula and plans the technical and vocational education institutions are conferred the right to redistribute training time required to study the modules such as the basics of economics in the industry, the basics of law in the industry, and the psychology of communication.

### **Educational programs aimed at training, provide:**

- 1) study of general professional and professional modules;
- 2) performance of laboratory and practical classes on general professional and professional modules;
- 3) passage of industrial training and professional internship/practice;
- 4) execution of a written qualifying (diploma) work.

In the structure of education in this specialty by all types and levels of qualification the following **general professional modules are defined:**

- Fundamentals of Information and automation;
- Document Management in a state language;
- Fundamentals of standardization, certification and metrology ,
- Engineering Drawing,
- Marketing

**The basic professional modules** occupy an important place in the overall

structure of educational programs in the training of qualified personnel. On the basic knowledge and skills that students acquire in the course of development of basic modules, depends their future competence to solve professional issues with the full awareness of the integrity of all processes and phenomena, to perform

competently course papers, theses and practical work in the specialty: issues with the full awareness of the integrity of all processes and phenomena, to perform competently course, theses and practical work in the specialty:

“Installation of electronic equipment”

“Installation, maintenance and repair of switching devices”

“Repair and adjustment of power sources”.

**Professional modules** defined for the Fetter of electronic equipment in the development of the working curriculum and working curriculum may be reconsidered by education institution according to the specialization, requirements of employers and characteristics of the region.

**The study of the professional module** is the basis of professional training of students.

In the curriculum in accordance with the National Qualifications Framework (NQF) of the Republic of the Republic of Kazakhstan the opportunity to transition of study of the content of professional program modules from level 3 to level 5 is provided.

As developing the educational programs of vocational modules the student can achieve the 3<sup>rd</sup> level **“Master on repair and maintenance of telecommunication and electronic equipment”** and to find a job. If the student wishes to achieve the qualification of “Electronic Technician”, he /she is continued to study for a further 10 months. To achieve the 5<sup>th</sup> qualification level **“Junior Electronic Technician”** the student can continue his / her education for a further 10 months.

**By qualification “Master on repair and maintenance of telecommunication and electronic equipment”, “Video surveillance and burglar alarm systems setter system” are defined the following modules:**

Repair and adjustment of low-frequency amplifiers;

Repair and adjustment of the combined devices and devices of magnetic and optical recording and reproducing sound and video recordings;

Repair and adjustment of CRT and LCD television equipment, plasma and LED panels.

As the study of these modules contributes to the acquisition of skills in the installation, maintenance and repair of electronic equipment and video surveillance, and burglar alarm.

**For qualification “Electronic Technician” the modules are defined as follows:**

Repair of equipment for digital sound and video recordings;

Repair of equipment of satellite reception and transmission;

Repair of electronic equipment with the use of new equipment;

Registration of normative documents.

Since they have a higher level and should ensure team work, supervise the work of team members, repair and adjustment of the electronic equipment with the

use of new technologies which are used in the world.

**By the qualification “Junior Electronic Engineer” the following modules are specified:**

Repair of modern types of electronic and microprocessor-based equipment;  
Methods of management and organization of work processes;  
Software of electronic equipment

**Students** should acquire practical skills to work with the software of the electronic equipment, work with all applications of software, be able to communicate fluently in technical English, provide overall management of service centers for maintenance and repair of electronic equipment.

The most important component of the program is the emphasis on practical training of students. To this end, professional modules and industrial training modules should be combined in developed educational programs.

The professional internship/practice is carried out in the respective organizations, workplaces, provided by employers on the basis of the contract, and it is aimed at forming professional competencies.

In colleges the professional internship/practice includes practical and technological sessions on modules. Classes are scheduled in classrooms, laboratories and workshops, aimed at consolidating the knowledge acquired during the theoretical training. These classes are aimed at the acquisition of practical skills and professional competences according to qualifications conferred. Timing and content of the practical training are defined by the working curricula, schedule of the educational process and working educational programs.

**The structure of professional internship/practice** provides for carrying out the following types of training practical work:

- “Introductory Internship/Practice” and “Industrial and technological Internship/Practice” to confer the working qualification “Fettler Tradesman for maintenance and service of telecommunication and electronic equipment”, “Video surveillance and burglar alarm systems settersystem”;

- To confer the qualification of mid-tier specialist “Electronic Technician” there is provided for “Technological (pre-graduation) internship/practice” in the amount of not less than 8 weeks;

- To confer the qualification of Bachelor of Applied Science “Junior Electronic Engineer” there is also provided an additional “Technological (pre-graduation) internship/practice” in the volume of not less than 8 weeks.

**This educational program** includes modules defined by education institution, which must take into account the personal inclination of students in the field of professional interests and requirements of the employer to training in this specialty.

To determine the quality of development of educational programs by students there is provided for the **intermediate and final attestation** in the curriculum.



Conducting *intermediate attestation* is provided in all disciplines and modules, the main forms of which are exam, test, control work.

Intermediate certification in general educational disciplines provides for examination in accordance with the RK CES.

The number of examinations, tests and control works in general humanitarian and economic, general professional and professional modules is determined on the basis of the requirements to the level of knowledge, skills and competences, which the student should have.

Control works and tests are carried out at the expense of teaching time allocated to study this module, exams – on the due date allocated to the intermediate attestation.

As a result of interim certification for a modular curriculum and passing the qualification exam for working professions which includes professional readiness level assessment and award students are assigned to the achieved vocational qualification level (category, class, category).

### **Final attestation**

The final attestation for the qualification of **“Master on repair and maintenance of telecommunication and electronic equipment”** is carried out according to the following professional modules:

- ✓ PM-01 “Repair and adjustment of low-frequency amplifiers”;
- ✓ PM-02 “Repair and adjustment of the combined devices and devices of magnetic and optical recording and reproducing sound and video recordings”;
- ✓ PM-03 “Repair and adjustment of CRT and LCD television equipment, plasma and LED panels”.

For the theoretical control of the level of knowledge the main emphasis is made on knowledge of electronics and electronic devices. Construction of all electronic devices and their installation is based on basic and professional modules. To practical control of the level there are mainly used professional modules PM-01; PM-02; PM-03, with that the students should demonstrate skills in electronic equipment repair and adjustment specified in professional modules.

During the final theoretical control of the level of knowledge by the qualification of **“Electronic Technician”** there is applied knowledge of basis and professional modules:

- ✓ PM-04 “Repair of equipment for digital sound and video recordings”;
- ✓ PM-05 “Repair of equipment of satellite reception and transmission”;
- ✓ PM-06 “Repair of electronic equipment with the use of new equipment”;
- ✓ PM-07 “Registration of normative documents”.

when the students should demonstrate knowledge on repair and adjustment of digital equipment, as well as knowledge of the design and management of regulatory documents. In the practical control the students demonstrate skills in the repair and adjustment of digital equipment and the correct filling of the approved forms.



### **For the qualification of “Junior Electronic Engineer”:**

During the final control of theoretical knowledge it is necessary to base on the professional module PM-10 “Software of electronic equipment” and some of the questions for the working qualifications and mid-tier specialist. Students should show knowledge of the personal computer, diagnostic methods and techniques of electronic equipment using the programmers and IT-technologies. In the practical control of the level of knowledge students should demonstrate skills in assembling and dismantling of microprocessors and chips using soldering stations and other modern devices for the diagnosis and repair of electronic and telecommunications equipment.

The final attestation of students on this educational program includes:

- assessment of students in educational institutions;
- assessment of the level of professional training and qualification award (for the set and advanced qualification levels).

The final attestation of students in educational institutions is carried out to determine the level of development of educational programs on the basis of studying the full training module.

Possible forms of final attestation in educational institutions on the basis of completion of training educational programs are: passing exams in basic general professional modules and professional modules or performance and defense of the thesis/diploma work with passing of the exam of the final attestation in one of the professional modules are determined independently by education institution in the development of the working curriculum +.

Assessment of the level of professional readiness and assignment of qualification (hereinafter the “ALPRAQ”) by specialties consists of two stages:

- 1) theoretical test on modules, determining professional readiness;
- 2) implementation of practical tasks by the level of qualification.

The amount of training time to carry out the final attestation is determined by no more than 2 weeks. Of these, to the organization and conducting the ALPRAQ is given at least 24 hours (volume of training time to carry out the ALPRAQ is determined independently by education institution depending on the specifics of the specialty and the organization of educational process).

### **Consultations and extra curriculars**

Advisory classes are conducted mainly in the disciplines and modules on which the plan of the training process provides intermediate and final attestation of students.

The list of disciplines and content of educational programs, amount of teaching time for consultation, time and form of consultation (group, individual, etc.) are determined by educational institutions.

The content of extra curriculars aimed at ensuring the development of the individual abilities of students and requirements. These kinds of extra curriculars may include classes of technical creativity, related to the future qualification and classes by sport and physical culture.

Extra curriculars are provided by the working curriculum of the education institution at the rate of no more than 4 hours a week and are not compulsory for the study.

***Note***

The practical training include: industrial, laboratory and practical classes, course works (projects), control works, etc.

In the development and implementation of working training programs and plans institutions of technical and vocational education may:

- change up to 30% of the training time devoted to the development of educational material for cycles and up to 30% in each discipline (module) and up to 50% of the industrial training and professional internship/practice while maintaining the total number of hours for compulsory education;

- select different training techniques, forms, methods of organization and control of the educational process;



- change the curriculum content up to 30% in general humanitarian and socio-economic modules and up to 50% in professional modules, industrial training and professional internship/practice in accordance with the needs of employers.






- introduce additional modules in professional modules for employers demand while maintaining the total amount of teaching time (hours / credit) for compulsory education;




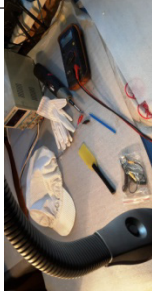
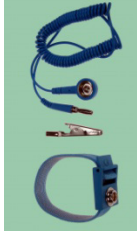

- choose forms, define the order and frequency of ongoing monitoring of academic progress of students and intermediate attestation of students;




The distribution of the learning time of training modules by courses may vary depending on the learning technologies, the specifics of the specialty, and other regional specificities.

## 9. List of recommended equipment

No	Name	Technical specification	Purpose of the equipment / Topics Covered	The module (s) in which the equipment is used	Units of equipment/ for a group of students	Total number	Comments	Picture (if possible)
<b>Workshop for maintenance and repair of electronic equipment Each workshop places 12 students</b>								
1	Laboratory power supply (with control of current and voltage)	current up to 5 A, the regulated voltage to 30 volts	Power to test equipment		Minimum 10	13		
2	Soldering station	Hot air station with a soldering iron	Soldering smd components, other soldering works		Minimum 10	13		

3	Screwdriver Set	Screwdrivers must be of different sizes from the smallest to the largest size	Opening the enclosure		Minimum 10	13	
4	Set of tools	Pliers, needle files, clip-pers, etc.					
5	Multimeter	Any digital device	To check the voltage, resistance, current measurement		Minimum 10	20	
6	Computer	Any modification, but not below WIN7			It is desirable for each student		
7	PROGRAMMERS	Any modification	To remove the information from the memory chip, and the recording the new		1-2	20	

8	TV signal generator	Laspi T001	Checking matrix, TV setup	1	20	
9	Oscilloscope	It is advisable to digital	Troubleshooting, test oscillograms	1-2	20	
10	PH2 Screwdriver	Electric screwdriver	Loosening screws on the equipment	5	20	
11	Safety gloves	Anti-static gloves		20	20	
12	Antistatic wrist strap	Wrist strap to remove static electricity		20	20	
13	Means for removing dust	Anti-static brush to remove dust from boards, matrices, loops		20	20	

14	Antistatic linoleum	Linoleum	For protection against static	1			
15	LCD matrix tester	Power to the matrix without the apparatus itself	To test the efficiency of LCD TVs and displays matrix	5	20		
16	Microscope	Increase up to 1000 times	To repair boards, replace small parts, search insulation tracks on the printed circuit board	5	20		
17	Electric soldering iron	Voltage 220 V Power 25, 40 watts	To perform soldering	12	12		
18.	Oscilloscope electron beam C1-67	The bandwidth of at least 10 MHz, 2nd accuracy class. The input impedance of 10 megohms.	To investigate (monitoring, recording, measuring) the amplitude and timing of the electric signal applied to its input, either directly on the screen	2/12	2		



19.	Electronic frequency counter	The upper limit of the measured frequency of at least 5 MHz. Permissible measurement error no more than $\pm 10\text{-}5$ of the measured value plus or minus 1 Hz.	To determine the frequency of a batch process or frequencies of the signal spectrum harmonic components.		1/12	1		
20.	Power meter AC	The rated voltage of 220 V. The upper measurement limit of not less than 100 watts. Accuracy class not lower than 0.5	For power measurement		1/12	1		
21.	Autotransformer laboratory	Nominal voltage 220 V Range of voltage regulation 150 V and 250 V. Power 250 watts.	To adjust the supply voltage for the repair and adjustment of electronic equipment		12 1/10	12		
22.	Voltmeter universal	Limit of effective range of DC voltage from 0.5 V to 300 V. AC voltage measurement limit of 0.5 to 300 V in a frequency range from 50 Hz to 10 MHz. Accuracy class 2.5.	For the measurement of AC, DC and impulse voltage		3/12	3		
23	Classic power supply	Voltage 36V	To check and control work			For every student		

24	Switching power supply						For every student		
25	Low frequency amplifier						For every student		
26	Combined devices for magnetic and optical recording of sound and image				To consolidate the theoretical knowledge and develop practical skills in the repair, maintenance and adjustment of the electronic equipment		For every student		
27	Television receiver using a CRT, LCD, plasma and LED panels				To consolidate the theoretical knowledge and develop practical skills in the repair, maintenance and adjustment of the electronic equipment		For every student		

28	Various types of electronic equipment		To consolidate the theoretical knowledge and develop practical skills in the repair, maintenance and adjustment of the electronic equipment				For every student		
29	Equipment for satellite reception and transmission		To consolidate the theoretical knowledge and develop practical skills in the repair, maintenance and adjustment of the electronic equipment	3/12	3				
30	Acoustic generator		To check and adjust the audio channel	4/12	4				
31	X1- 50 sweep oscillator		For the control and adjustment of the amplitude-frequency characteristics of the electronic equipment	6/12	6				

<b>10. Laboratory of electrical equipment and radio measurements</b> <b>Each workshop places 13 students</b>						
1.	Autotransformer laboratory	Nominal voltage 220 V Range of voltage regulation 150 V and 250 V. Power 250 watts.				
2.	A set of electronic components	Resistors, capacitors, inductors, diodes, thyristors, semiconductor transistors, transformers				
3.	Amperemeter	DC measuring range from 1A to 30A	To measure the current intensity			
4.	Voltmeter universal	Limit of effective range of DC voltage from 0.5 V to 300 V. AC voltage measurement limit of 0.5 to 300 V in a frequency range from 50 Hz to 10 MHz. Accuracy class 2.5.	For the measurement of AC, DC and impulse voltage			
5	Megaohmmeter	M 4001 1000B	To measure the insulation resistance			

## 8. *List of further reading*

Table 6

No	Name and number of the publication	Author	Publishing house	Year* and place of publication	The module (s), in which it is used
1	Law of the Republic of Kazakhstan «On Technical Regulation»		Astana	09.11.2004 No 603-II	
2	Law of the Republic of Kazakhstan «On Protection of Consumer Rights»		Astana	04.05. 2010 No 274-IV	
3	Law of the Republic of Kazakhstan «On Uniformity of Measurements»		Astana	07.06.2000 No 53-II	
4	Law of the Republic of Kazakhstan «Protection of Intellectual Property Rights»		Astana	12.01.2012 No 537- IV	
5	ST RK 1.27-2013 The state system of technical regulation of the Republic of Kazakhstan. Standardization of terminology. Basic Principles and Methods			2013	
6	ST RK 2.3-2009 The national system for ensuring the uniformity of measurements of the Republic of Kazakhstan. Measurement standards. The main provisions procedure of creation, approval, storage and application			2009	
7	ST RK 2.15-2013 The national system for ensuring the uniformity of measurements of the Republic of Kazakhstan. The state metrological control and metrological control. General provisions			2013	

8	Electrotechnics Handbook Volume 1 and Volume 2	V.L. Likhachev	M; SO- LON-Press	2007	
9	Marking electronic components	D.A. Sadchenkov	SOLON-P	2002	
10	Power supply units of modern TVs	A.V. Rodin N.A. Tyunin I.A. Morozov	SOLON-P	2002	
11	Domestic semi-conductor devices	A.I. Aksyonov A.V. Nefodorov	M; SO- LON-Press	2005	
12	Microchips for modern monitors	N.A. Tyunin	M; SO- LON-Press	2004	
13	Practice of cell phone repair	N.A. Tyunin A.V. Rodin	M; SO- LON-Press	2005	
14	DVD, VCR, HDD recorders and players	N.A. Tyunin A.V. Rodin	M; SO- LON-Press	2008	
15	Portable LCD televisions	N.A. Tyunin	M; SO- LON-Press	2008	
16	Automotive and stationary audio systems	N.A. Tyunin A.V. Rodin	M; SO- LON-Press	2009	
17	Satellite television. Installation, connection, repair	A.A. Danilin	M; SO- LON-Press	2009	
18	LG televisions	N.A. Tyunin A.V. Rodin	M; SO- LON-Press	2009	
19	Repair, adjustment and testing radiotelevision sets	P.I. Misyul	M; SO- LON-Press	2007	
20	«Occupational Health and Safety»	Zh.K. Amanzholov	Astana, Foliant	2007	



21	Law of the Republic of Kazakhstan «On occupational safety and health»				2004	
22	«Occupational Health »	M.A. Nurzhasarova et al.	Astana, Foliant		2007	
23	« Ecology and Politics »	T.A. Alimbayev	Astana, Academy of Public Administration under the President of RK		2003	
24	1001 secrets of TV technician	M. Ryazanov	Ozon		2007	
25	Basics of television technology. Television receivers	Vladimir Vinogradov	Ozon		2012	
26	Electronics. Full course of lectures. Textbook	Victor Pryanishnikov	Ozon		2012	
27	Theoretical Foundations of Electronics. Course of lectures	Victor Pryanishnikov	Ozon		2012	
28	Electrical Engineering and Theoretical Fundamentals of Electrical Engineering in examples and problems. A Practical guide	Petrov, Yuriyn Osipov	Ozon		2013	
29	Research of SMPS circuits	Vladimir Kubov	Ozon		2010	
30	Installation and repair of satellite, cable and terrestrial receivers	Vasily Fedorov	Ozon		2015	
31	Design board of telecommunication systems	LAP Lambert Academic Publishing			2011	