

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

EDUCATIONAL PROGRAM

specialty **1413000 “Production of concrete and metal products
(by types)”**

Qualifications:

**Steelfixer - welder
Moulder –concreter - hookman
Technician - technologist
Junior production engineer**

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Non-commercial Joint Stock Company “Holding “Kasipkor”

Experts:

Operatives Projektmanagement (Poland)

RALE “Association of builders of Kazakhstan”

Academic Methodological Association on profile “Construction” on the basis of “Almaty college of Construction and management”,

ENTERED by Non-commercial Joint Stock Company “Holding “Kasipkor”

REVIEWED AND APPROVED at the meeting of the Republican Educational-Methodical Council for the Development of Technical and Vocational Education of the Ministry of Education and Science of the Republic of Kazakhstan, the minutes No. 4 of " 21" 12 . 2016

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Contents

1. Program description	7
2. List of abbreviation and symbols	9
3. Specialty analysis	10
3.1. Functional card of specialty qualifications	12
4. Requirements to the students' training level	15
5. Structure of the educational program	18
6. Content of educational programs (modules)	73
7. Curriculum	125
8. Explanatory note	131
9. The list of the recommended equipment	134
10. The list of the recommended literature	180

1. Program description

This curriculum in the specialty of 1413000 "Production of concrete and metal products (by type)" uses the following regulations:

- 1.1.1 The law of the Republic of Kazakhstan dated 27 July 2007 "On Education"
- 1.1.2 State obligatory standard of technical and vocational, post-secondary education (Decree of the Government of the Republic of Kazakhstan dated 13.05.2016, No.292)
- 1.1.3 State Program for Education Development of the Republic of Kazakhstan for 2011 - 2020 (Decree of the President of Kazakhstan dated 7 December 2010 No.1118)
- 1.1.4 Development of Strategy of NJSC "Holding "Kasipkor" 2012-2021 (Decree of the Government of the Republic of Kazakhstan dated 31 December 2011 No. 1751)
- 1.1.5 State program for the industrial-innovative development of the Republic of Kazakhstan for 2015-2019 (Decree of the President of the Republic of Kazakhstan dated 19 March 2010 No. 957)
- 1.1.6 National Qualifications Frame of the Republic of Kazakhstan (joint order of the Minister of Labour and Population Social Protection of the Republic of Kazakhstan dated 24 September 2012 No.373 and the Minister of Education and Science of the Republic of Kazakhstan dated 28 September 2012 No.444)

The curriculum in the specialty: 1413000 - "Production of concrete and metal products (by type)" is designed to train a new generation of skilled workers in the production of concrete and metal products for the factories of the Republic of Kazakhstan and on the basis of consultations with employers in the country, technological modernization and innovation and science development; creating of prerequisites for self-exploration and research activities of students in the framework of the experiment at all its stages; ability to work with scientific and technical information, to use domestic and foreign experience in professional activities, organize and summarize the information.

To achieve the aims of the curriculum the following objectives are solved:

- determine the qualifications and their labor functions;
- determine requirements for the students' training level, including the necessary basic and professional competence by the levels in accordance with the national qualifications framework and professional standards;
- make a curriculum with an explanatory note;
- develop the structure and content of the curriculum (modules);
- compile a list of recommended equipment and bibliography.

The integrated curriculum in the specialty of 1413000 "Production of concrete and metal products (by type)" is an interlayer and provides for training in the following qualifications:

– *Steelfixer - welder*

- *Moulder –concreter - hookman*
- *Technician - technologist*
- *Junior production engineer*

The experimental curriculum includes training of skilled workers according to their profession, issuing of a certificate of skilled workers in the above qualifications.

The curriculum allows giving students deep theoretical knowledge and practical skills required at plants.

The ultimate goal of the program is training direction for an integrated curriculum in the specialty of **1413000** "Production of concrete and metal products (by type)" implies a clear orientation for the future, which is in the possibility of building their education, taking into account the success in personal and professional activities, satisfying the employers' requirements.

Code and profile of education:		
Code and specialty name: 1413000 - "Production of concrete and metal products (by type)"		
Code and name of qualification: <i>Technician - technologist</i> <i>Junior production engineer</i>		
Qualification level NRC, ORK		Level III-V
<i>Steelfixer - welder</i> <i>Moulder –concreter - hookman</i> <i>Technician - technologist</i> <i>Junior production engineer</i>		
Study duration:		
Educational admission base	Code and name of qualification	Standard term of mastering the curriculum by qualification levels
On the basis of basic general education	Higher level	Higher level
	<i>Steelfixer - welder</i>	2 years 10 months
	<i>Moulder –concreter - hookman</i>	2 years 10 months
	Mid-ranking specialist	
	<i>Technician - technologist</i>	+10 months
	Applied Bachelor's programme	
	<i>Junior production engineer</i>	+10 months

2. List of abbreviation and symbols

The developed curriculum applies the following abbreviations:

LRK Law of the Republic of Kazakhstan;

SCS State compulsory standards;

GHSED general humanitarian and socio-economic disciplines;

GED general education disciplines;

EOD education organization determined disciplines;

GPD general professional disciplines;

SD special disciplines;

TT theoretical training;

GPM general professional modules;

SM special modules;

PP Professional Practice;

GP graduation project;

IC intermediate certification;

APTLCQ assessment of the professional training level and conferring of the qualification;

A advice;

O-optional courses;

E exams;

FC final state certification;

VT vacation time

3. Specialty analysis

1413000 Production of concrete and metal products	
<div>Qualifications</div> <div>Labor qualification</div> <div>A. Steelfixer</div>	<div>Qualification requirements</div> <div>A1. Steel cutting and bending</div> <div>A2. Making grids, skeletons</div> <div>A3. Production of embedded items</div> <div>A4. Methods of applying lifting devices and mechanisms for mounting fixtures, reinforced structures and prestressing reinforcement of all kinds</div> <div>A5. Marking the location in the template or jig plates and aligning drawings and sketches of rods, simple grids and flat skeletons</div> <div>A6. Weld reinforcement preparation rules, including bathroom method</div> <div>A7. Spatial reinforcement cages assembly rules</div> <div>A8. Production of reinforcing beams of the individual wires and strands</div>
<div>Labor qualification</div> <div>B. Moulder –concreter - hookman</div>	<div>B1. Strapping products and feeding it to the place of heat processing</div> <div>B2. Demoulding the product after heat treatment with transportation to the finishing post or stockpile</div> <div>B3. Operation of concrete pavers, vibrators, vibrostamps, centrifuges and assemblies and equipment, performing a number of different operations</div> <div>B4. Monitoring the quality of products</div> <div>B5. Participation in the maintained equipment repair</div> <div>B6. Molding of reinforced concrete products on machines of different structures</div> <div>B7. Regulation of the machine speed stroke</div> <div>B8. Participation in the repair and corrective maintenance of the equipment</div>

Mid-ranking specialist

C. Technician - technologist

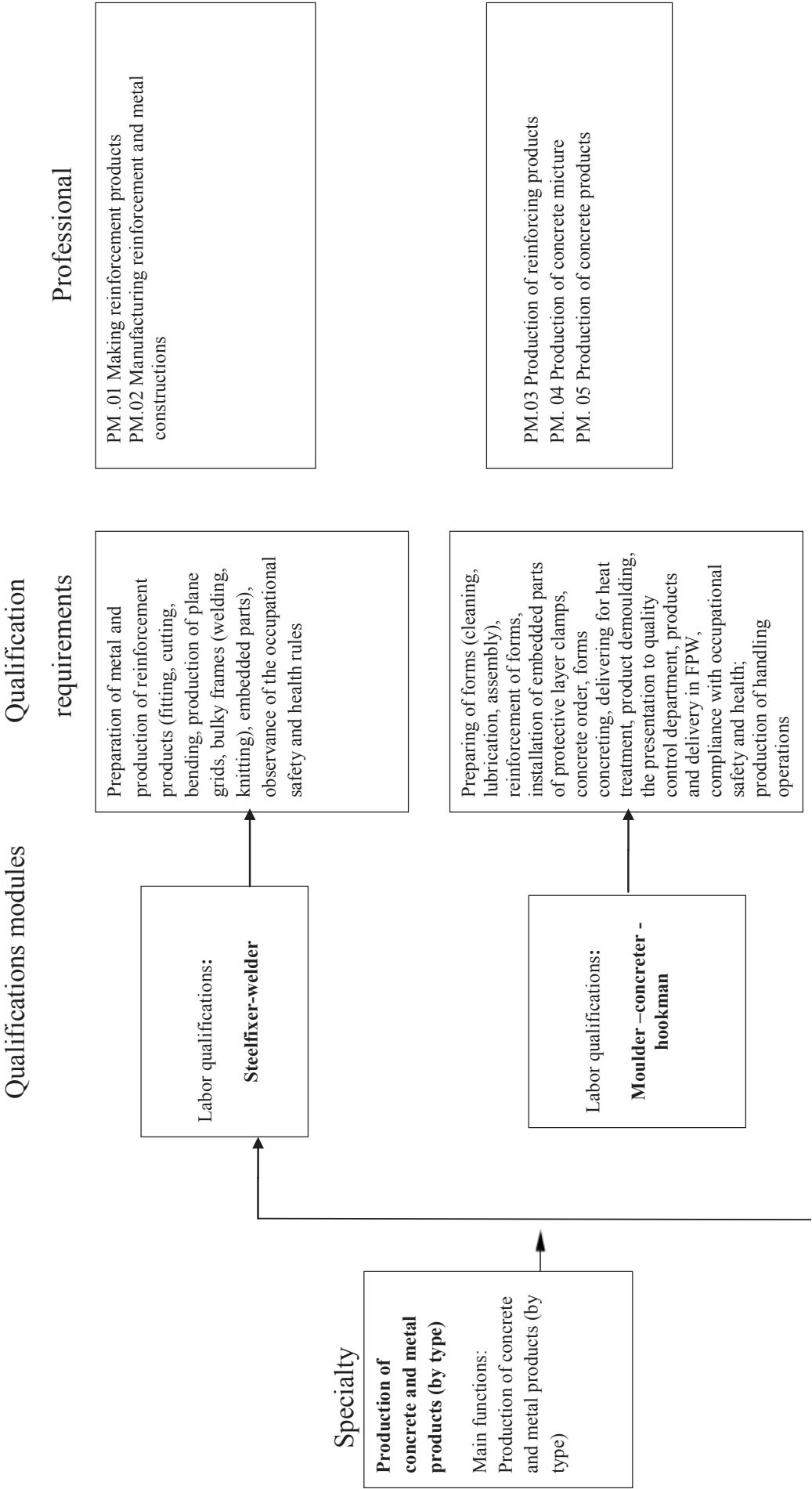
- C1. Implementing under the guidance of a qualified person, advanced technological processes and optimal production conditions into simple products or its components
- C2. Complying with high quality products, reducing material and labor costs for its manufacture
- C3. Setting up step-by-step route of parts processing and products assembly during the manufacturing and controlling over all technological sequencing operations
- C4. Mapping technological process and other technical documentation
- C5. Monitoring the employees 'compliance with occupational health and safety
- C6. Identifying the causes of products defects, participating in the preparation of proposals for the prevention and elimination

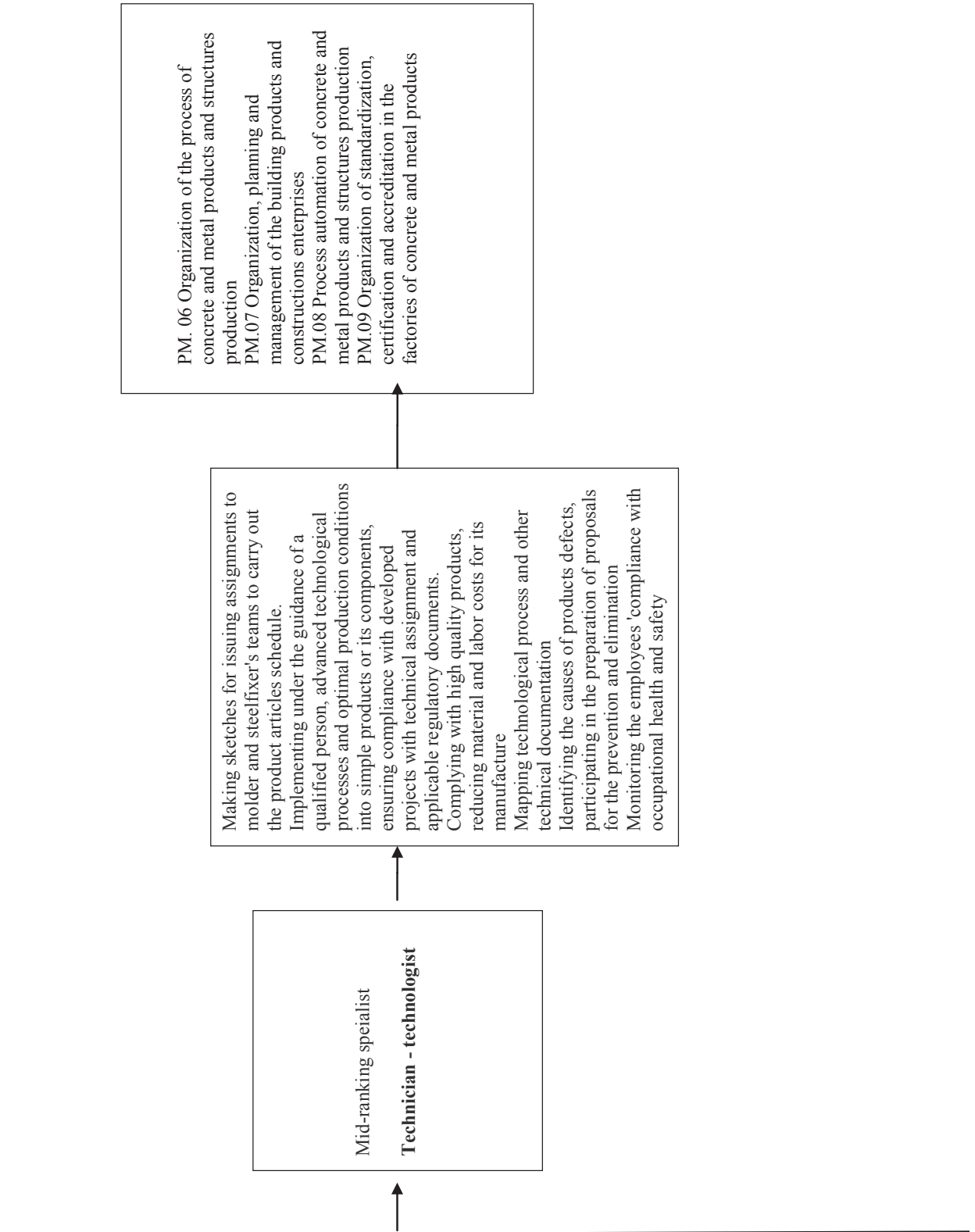
Applied bachelor's program

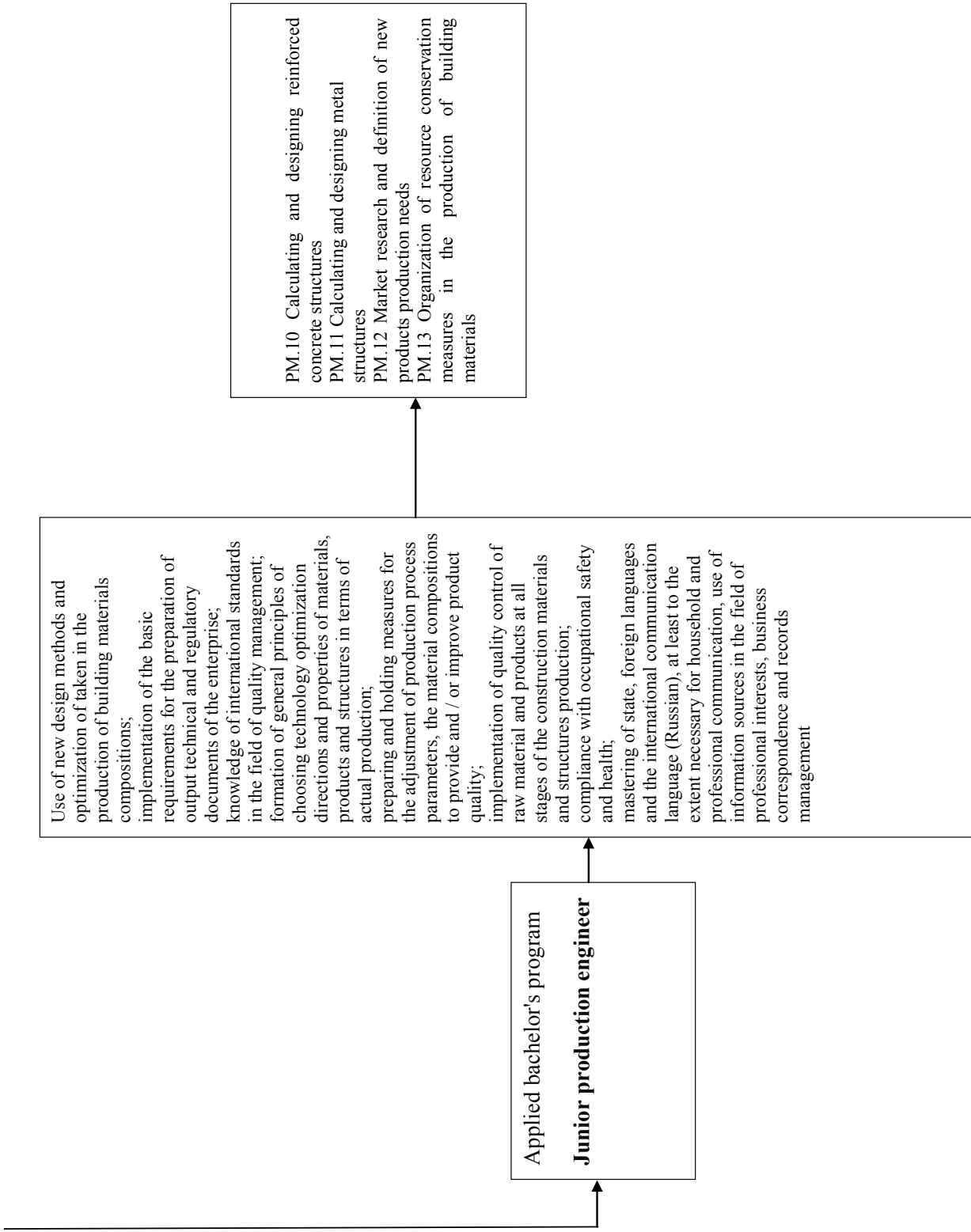
D. Junior production engineer

- D1. Ability to use regulatory documents in their activities
- D2 Ability to perform and interpret drawings and construction details structures
- D3 Ability to use modern information space
- D4 Ability to find the organizational and managerial decisions in unusual situations and willingness to take responsibility for them
- D5 Awareness of the profession, possession of a high motivation for its implementation
- D6 Mastering of production lines designing methodology
- D7 Application of feasibility studies and the choice of materials in the production of concrete and metal products
- D8 Mastering of process equipment adjusting, repair and maintenance methods
- D9 Mastering of calculation methods and choice of equipment, means of automation and short-circuit protection
- D10 Organization and application of new technologies for installation, maintenance, repair and adjustment of technological equipment
- D11 Mastering of basics of production team organization and management, the system of preventative maintenance and efficient operation of technological equipment

3.1. Functional card of specialty qualifications







4. Requirements to the students' training level

The section "Students' training level requirements" defines the necessary basic competencies and professional competence by the levels of related specialty qualifications in accordance with the national qualifications framework, sectoral qualifications frameworks and professional standards.

Com- pe- ten- cies	Industry/enterprise requirements for the training of students			
Basic competencies	Junior production engineer	Technician -technologist	Moulder –concreter - hookman	BC 1 Update knowledge and skills throughout life BC 2 Know to work independently and in a team BK 3 Organize the workplace, prepare equipment, tools, appliances, feedstock for the production process BC 4 Choose the most rational ways and means of professional activities BC 5 Have skills to work with the technical documentation and reference literature, standards and regulations BC 6 Have the thinking culture, master the state language of the Republic of Kazakhstan - Kazakh language and official use language - Russian. Use properly the professional vocabulary, apply knowledge of a foreign language in his professional activity BC 7 Improve the professional knowledge and skills BC 8 Comply with safety regulations, fire safety, industrial hygiene; BC 9 Have skills of computer methods of data collection, storage and processing; BC 10 Promote a healthy lifestyle, have abilities and skills of physical self-improvement
			Steelfixer-welder	BC 1 Update knowledge and skills throughout life BC 2 Organize his own activities, determine the methods and ways to perform professional tasks, assess their effectiveness and quality. BC 3 Solve problems, assess risks and make decisions in unusual situations. BK 4 Search for, analyze and assess information necessary for formulating and solving professional problems, professional and personal development. BC 5 Use information and communication technologies for the improvement of professional activity. BC 6 Work in a team, ensure its unity, communicate effectively with colleagues, leadership, customers. BC 7 Set goals, motivate subordinates, organize and supervise their work assuming a responsibility for the outcome of their assignments. BC 8 Define independently the tasks of professional and personal development, practice self-education, plan consciously an advanced training. BC 9 Be prepared for changing technologies in professional work. BC 10 Promote a healthy lifestyle, have abilities and skills of physical self-improvement

BC 1 Update knowledge and skills throughout life
BC 2 Organize his own activities, determine the methods and ways to perform professional tasks, assess their effectiveness and quality.
BC 3 Solve problems, assess risks and make decisions in unusual situations.
BK 4 Search for, analyze and assess information necessary for formulating and solving professional problems, professional and personal development.
BC 5 Use information and communication technologies for the improvement of professional activity.
BC 6 Work in a team, ensure its unity, communicate effectively with colleagues, leadership, customers.
BC 7 Set goals, motivate subordinates, organize and supervise their work assuming a responsibility for the outcome of their assignments.
BC 8 Define independently the tasks of professional and personal development, practice self-education, plan consciously an advanced training.
BC 9 Be prepared for changing technologies in professional work.
BC 10 Promote a healthy lifestyle, have abilities and skills of physical self-improvement

Professional competencies	Junior production engineer	Technician -technologist	Moulder –concreter - hookman	Steelfixer-welder	<p>PC 2.1.1 Accept materials.</p> <p>PC 2.1.2 Clean metal from corrosion (if necessary).</p> <p>PC 2.1.3 Prepare metal (fitting and cutting).</p> <p>PC 2.1.4 Manufacture reinforcing products (bending, manufacturing of plane grids).</p> <p>PC 2.1.5 Manufacture bulky frames (welding, binding).</p> <p>PC 2.1.6 Manufacture embedded parts.</p>
					<p>PC 2.2.1 Prepare forms (cleaning, lubrication, assembly)</p> <p>PC 2.2.2 Reinforce forms, according to the working sketches, drawings.</p> <p>PC 2.2.3 Install embedded parts of the protective layer clamps.</p> <p>PC 2.2.4 Make orders and acceptance of the concrete mixture.</p> <p>PC 2.2.5 Concrete the form.</p> <p>PC 2.2.6 Deliver products for heat treatment.</p> <p>PC 2.2.7 Mold goods.</p> <p>PC 2.2.8 Present products to the quality control department</p>
			<p>PC 3.1 Prepare sketches based on the working drawings for the issue of assignments to brigades of molders and steelfixers to perform the products manufacturing schedule.</p> <p>PC 3.2 Monitor compliance with the highest quality products, reduced material and labor costs for its manufacture.</p> <p>PC 3.3 Control post operational route of the parts processing and products assembly during the manufacturing and control over all operations of technological sequencing.</p> <p>PC 3.4 Participate in drafting process maps and other technical documentation.</p> <p>PC 3.5 Participate in identifying the causes of the products defects, in preparing proposals for its prevention and elimination.</p> <p>PC 3.6 Monitor compliance with occupational safety and health.</p> <p>PC 3.7 Participate in the implementation of advanced technological processes and optimal modes of production under the guidance of more qualified professional, thus ensuring compliance with developed projects with technical requirements and applicable regulatory documents.</p>		
			<p>PC 4.1 Carry out experimental research and design and experimental works to optimize process parameters of production and improve product quality, introduce new technologies and products;</p> <p>SC 4.2 Produce building materials and structures;</p> <p>SC 4.3 Carry out works on certification and quality control of construction materials and structures;</p> <p>PC 4.4 Make technological designs of production processes;</p> <p>PC 4.5 Optimize, improve and introduce new materials and structures manufacturing techniques;</p> <p>PC 4.6 Control technological processes;</p> <p>PC 4.7 Carry out works on the organization of the enterprise (and/or its business units) and management of production and business activities;</p> <p>PC 4.8 Implement quality control of raw material and products at all stages of the production of construction materials and structures;</p> <p>PC 4.9 Assess and monitor the quality of construction and installation works</p>		

5. Structure of the educational program

Professional competences	Training module	Learning objectives			Code of the generated basic competence
		Knowledge	Skills	Abilities	
Qualifications: Steelfixer - welder, Moulder –concreter - hookman					
Basic general professional modules					
PC 2.1.1 Accepts materials. PC 2.1.5 Manufactures bulky frames (welding, binding). PC 2.2.6 Deliver products for	Transportation of cargo of the various kinds	- standards and regulations of sling works; - lifting machinery and mechanisms; - purpose and rules of lifting devices and accessories; - principle of lifting devices; - marginal rates of the	- prepare equipment for work; - choose lifting devices and accessories, appropriate to the slinging scheme, weight and dimensions of transported cargo; - determine the suitability of slings, splicing and binding of slings with	- send the signals to the crane operator; - engage and disengage sling on site of installation or laying; - form stacks.	BC 1 - BC 10

<p>heat processing.</p> <p>PC 2.2.8</p> <p>Presents products to QCD and deliver them to finished product warehouse</p>		<p>crane and sling loads;</p> <ul style="list-style-type: none"> - required length and diameter of the slings to move the goods; - rules and methods of splicing and binding slings; - service life of slings, their carrying capacity, methods and timing of the test; - interpretation rules of loads slinging drawings and schemes; - visual determination of weight and center of gravity of movable goods, the most convenient place of 	<p>different nodes;</p> <ul style="list-style-type: none"> - interpret slinging loads drawings, diagrams; - rational organization of the workplace at slinging and linking different building cargo and structures, creation of safe working conditions, and slinging and linking of small sized cargo, slinging with mortar and concrete mixtures, - slinging and linking of the timber cargo; - slinging and linking of precast concrete and metal structures, scaffolding and other large-size 	
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			<p>construction cargo, slinging and linking of the technological equipment, monitoring of the load when lifting, moving and stacking;</p> <p>- compliance with work safety regulations</p>		
	<p>slinging loads;</p> <ul style="list-style-type: none"> - rules of slinging, lifting and moving of small sized cargo, containers with mortar and concrete mixtures, timber cargo, precast concrete and metal products, technological equipment and other large-size construction materials; - conditional signaling for crane operators; - purpose and rules of slings-ropes, chains, ropes, etc.; - ways of the rational organization of the 				

		<p>slinger's workplace; - basics of metrology and measurement tools; - safety measures and environment protection measures</p>			
<p>PC 2.1.1 Accept materials. PC 2.2.4 Make orders and acceptance of the concrete mixture. PC 2.2.8 Presents products to QCD and</p>	<p>Laboratory tests for the quality control of materials and products</p>	<p>- control types and methods; - basic technological processes that require technical and laboratory control; - requirements of laws, technical regulations, GOST ISO/IEC 17025 and other RD; - types of technological schemes and their quality control features</p>	<p>- use test equipment and measuring instruments; - distinguish and evaluate the quality of concrete mixtures and make corrective actions; - use statistical methods to assess the materials quality; - choose a control method and use the destructive testing methods and non-destructive testing</p>	<p>- operation skills with a ruler, tape measure, caliper, conveyor, device for measuring the width of cracks, scales, dispensers, etc.</p>	BC 1 - BC 10

<p>deliver them to finished product warehouse</p> <p>PC 3.2</p> <p>Monitor the compliance with the highest quality products, reduced material and labor costs for its manufacture.</p> <p>PC 3.3</p> <p>Control post operational</p>		<p>in the production of concrete mixtures, reinforcement products, reinforced concrete products and structures;</p> <p>- laboratory equipment and its requirements;</p> <p>- kinds and types of measuring instruments, their state standards requirements;</p> <p>- statistical methods of control results processing;</p> <p>- requirements for laboratory documents and records.</p>	<p>methods.</p> <p>- adjust the concrete mixture</p> <p>- select the heat processing mode according to the durability requirements for reinforced concrete structures and, if necessary, to carry out its correction. Know to use thermal equipment</p> <p>- receive information from drawings, GOST, ST RK, projects, regulatory documents for test methods necessary for testing of reinforced concrete, concrete, reinforcing products.</p>		
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route of the parts processing and products assembly during the manufacturing and control over all operations of technological sequencing.					
PC 3.5 Participate in identifying the causes of the products defects, in					

preparing proposals for its prevention and elimination. PC 4.3 Carry out works on certification and quality control of construction materials and structures;						
PC 2.1.1 Accept materials. PC 2.1.3	Quality control of reinforcement and metal	- properties of metals and alloys, methods of their study, prospects for the material studies	- use measuring instruments; - distinguish and evaluate the importance of the	- operation skills in measuring instrument; - work with reference books;	BC 1- BC 10	

Prepare metal (fitting and cutting).	products and structures	<p>development; - basic technological methods of steel welding, welding mode setting rules on the set parameters, main defects of welded joints and their causes; - requirements of laws, technical regulations and other RD; - quality control types and schemes in the manufacture of reinforcement and metal products and structures; - features of acceptance methods of non-standard metal</p>	<p>found defect in reinforcing and metal products and structures, the possibility of its correction; - use the table of tolerances, reference books; - operate with equipment that tests reinforcing and metal products and structures; - control the size of the template, conductors - receive the necessary information from the drawings, GOST, ST RK, projects. - collect and process (analyze) statistical data</p>	- work with the test equipment.	
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			<p>structures;</p> <ul style="list-style-type: none"> - requirements and tolerances for welding of any kind; - knows the levels of work complexity and welders qualifications', admitted to the various types of welds; - kinds and types of measuring instruments, they state standards requirements; - acceptance methods of reinforcement and metal products and structures; - requirements for drafting quality documents 	<p>- decide on the conformity (or no) of products (the raw material, components, etc.) with regulatory requirements, specifications, drawings, projects</p>		
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PC 2.2.2 Reinforce forms, according to the working sketches, drawings. PC 2.2.4 Make orders and acceptance of the concrete mixture. PC 2.2.5 Concrete forms. PC 2.2.8 Presents products to	Quality control of reinforced concrete products	<ul style="list-style-type: none"> - control types and methods; - basic technological processes that require technical control; - requirements of laws, technical regulations and other RD; - types of technological schemes and their quality control features in the production of reinforcement products, concrete products and structures; - requirements and tolerances to reinforcing products and concrete products; 	<ul style="list-style-type: none"> - use measuring instruments; - distinguish and evaluate the importance of the found defect in reinforcing and metal products and structures, the possibility of its correction, together with the technologist and foreman to develop and produce a corrective actions; - use tolerances tables; - process control results statistical methods; - calculate the load for the concrete products and arrange a test of strength, hardness, fracture 	<ul style="list-style-type: none"> - operation skills with measuring instrument; - work with reference books; - work with the test equipment. 	BC 1- BC 10
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QCD and deliver them to finished product warehouse	- kinds and types of measuring instruments, their state standards requirements; - statistical methods of control results processing; - requirements for drafting quality documents	- receive the information necessary for reinforced products from the drawings, GOST, ST RK, projects.	toughness;	
Professional modules				
Qualification: Steelfixer - welder				
PC 2.1.1 Accept materials.	Production of reinforcement products	- properties of metals and alloys, methods of their study, prospects for the material science development; - theoretical fundamentals of	- preparing the equipment for operation; - distinction and evaluation of the form of welded joints and surfaced coatings and their characteristics;	- operation skills with the equipment, which makes cleaning, cutting, welding, binding. - operation skills with templates, conductors
PC 2.1.2 Clean metal from corrosion (if				BC 1- BC 10

necessary). PC 2.1.3 Prepare metal (fitting and cutting). PC 2.1.4 Manufacture reinforcing products (bending, manufacturing of plain grids). PC 2.1.5 Manufacture bulky frames (welding, binding). PC 2.1.6		concrete with specified properties; - main technological processes: preparation of concrete mixtures, forming of different concrete structures and their heat processing; - fundamentals of metallurgical processes for welding and surfacing, the structure of welded joints, welding and facing materials and equipment for welding and surfacing; - basic technological methods of steel	- reasonable and right choice of welding and fusing materials and types of welding and surfacing in order to ensure a quality details connection; - interpretation of working sketches, drawings and the fulfillment of their requirements.	
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Manufacture embedded parts.		<p>welding, welding mode setting rules on the set parameters, main defects of welded joints and their causes; - types of modern welding equipment, function and operation regulations, power sources; - basics of metrology and measuring tools; - safety measures in welding works and environment protection measures</p>			
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PC 2.1.1 Accept materials.	Production of reinforcing and metal products	<ul style="list-style-type: none"> - basics of welding technology and steel structures assembly; - main parameters of welding and cutting modes; - safety measure basics for working with welding equipment; - types of welding; - characteristics and features of welding processes. - energy sources for welding; - features of the impact of shielding gas and electrode coatings on the welding arc; 	<ul style="list-style-type: none"> - organize the welder's workplace; - master the technique of welding works at electric welding and gas welding works, setting and adjustment of the equipment; - evaluate the weldability of the alloy based on its chemical composition, characterized by mechanical properties of alloys; - make calculations of basic parameters of welding conditions; - accept the materials by type; 	<ul style="list-style-type: none"> - operation skills with welding equipment; - works on marking and installation of templates, conductors; - works on edges manufacturing, electrodes selection, elements tack welding 	BC 1 - BC 10
PC 2.1.2 Clean metal from corrosion (if necessary).					
PC 2.1.3 Prepare metal (fitting and cutting).					
PC 2.1.4 Manufacture reinforcing products (bending, manufacturing of plain					

grids). PC 2.1.5 Manufacture bulky frames (welding, binding). PC 2.1.6 Manufacture embedded parts.		<ul style="list-style-type: none"> - heat distribution in solids under the influence of the thermal welding cycle; - main criteria for assessing the weldability of industrial alloys; - basic technology of the automated welding production; - function of welding rectifiers and transformers; - current-voltage characteristics of the standard welding rectifiers and transformers; 	<ul style="list-style-type: none"> - prepare structural steel and reinforcement; - master methods of marking and installation of templates, conductors; - master methods of edges manufacturing, electrodes selection, elements tack welding; - assemble metal structures; - weld metal structures; - apply the safety measures for works 		
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		design			
Qualification Moulder –concreter - hookman					
PC 2.2.5 Concrete forms. PC 2.2.6 Deliver products for heat processing	Manufacturing concrete mixtures	<ul style="list-style-type: none"> - different types of building materials and their properties; - features of the production and application technology, composition relationship, structure and properties of building materials; - theoretical foundations of concrete studies and obtaining of concrete with specified 	<ul style="list-style-type: none"> - prepare the equipment for work; - choose the necessary materials for concrete, determine their suitability, determine the basic properties of concrete and other materials, taking into account the requirements of regulatory documents 	<ul style="list-style-type: none"> - operation skills in the mixing equipment with dosing and conveying devices; - definition skills of the main properties of the concrete mixture 	BC 1- BC 10

			<p>properties;</p> <ul style="list-style-type: none"> - main technological processes: preparation of concrete mixtures, forming of different concrete structures and their heat processing, and production control; - equipment for the materials transport and storage, equipment for materials dosing and mixing; - rules for the concrete mixtures transport; - basics of metrology and measuring tools; - safety measures of welding works and 		
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		environment protection measures			
PC 2.2.1 Prepare forms (cleaning, lubrication, assembly) PC 2.2.2 Reinforce forms, according to the working sketches, drawings. PC 2.2.3 Install embedded	Manufacturing reinforced concrete mixtures	<ul style="list-style-type: none"> - basic characteristics of concrete, their quality indicators, - basics of manufacturing technology of concrete and concrete products, building codes, state standards and other guidance; - equipment for the concrete mixture transportation, the terms and conditions of concrete mixtures transportation, equipment for laying of 	<ul style="list-style-type: none"> - prepare forms, receiving and molding equipment to work - collect the reinforcement cage in the form; - put the embedded parts; - set the thickness of the protective layer - use measuring tools, templates, conductors 	<ul style="list-style-type: none"> - operation skills with concrete distributing and vibrating equipment, conductors, templates and measuring tools; - prestressing equipment. 	BC 1- BC 10

parts of protective layer clamps. PC 2.2.7 Mold products. PC 2.2.8 Presents products to QCD and deliver them to finished product warehouse		concrete mixtures; - properties of metals and alloys, methods of their study, the prospects for the material study development; - properties of reinforced concrete; - methods for testing reinforced concrete products; - basics of metrology and measuring tools; - safety measures and environment protection measures		
Qualification Technician -technologist				
Professional modules				

<p>PC 3.2 Monitor the compliance with the highest quality products, reduced material and labor costs for its manufacture.</p> <p>PC 3.4 Participate in the drafting process maps and other</p>	<p>Studying the basic properties of building materials and structures</p>	<p>- relationship of composition, structure and properties of construction and building materials; - ways for forming the given structure and properties of materials at the maximum resource and energy efficiency; - methods for studying the properties of construction materials, and methods for assessing their quality indicators.</p>	<p>- choose properly construction materials, ensure the required reliability performance, safety, economy and efficiency of facilities under specified operating conditions; - analyze the environment impact on the material in the design, establish requirements for the building and construction materials under the specified operating conditions - use the methods and means of controlling the physical and mechanical</p>	<p>BC 1 - BC 10</p>
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<p>technical documentati on PC 3.5 Participate in identifying the causes of the products defects, in preparing proposals for its prevention and elimination. PC 3.7 Participate in the</p>			<p>properties of the materials in the designs.</p>		
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<p> implementati on of advanced technologica l processes and optimal modes of production under the guidance of more qualified professional, thus ensuring compliance with developed projects with </p>					
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technical requirements and applicable regulatory documents.					
PC 3.1 Prepare sketches based on the working drawings for the issue of assignments to brigades of molders and steelfixers to perform the products	Organization of the production process of concrete and metal products and structures	<ul style="list-style-type: none"> - building standards, state standards and other guidance; - basic characteristics of concrete, their performance quality; - basics of manufacturing technology of concrete and concrete products; - main methods of testing concrete and reinforced concrete 	<ul style="list-style-type: none"> - calculate the selection of the concrete composition of various purposes; - select the concrete compositions of a specified quality; - develop the technological scheme of concrete products production; - design the technological process of manufacturing 		BC 1- BC 10

<p>manufacturing schedule.</p> <p>PC 3.2</p> <p>Monitor the compliance with the highest quality products, reduced material and labor costs for its manufacture.</p> <p>PC 3.3</p> <p>Control post operational route of the parts</p>		<p>structures;</p> <ul style="list-style-type: none"> - reinforcing steel, elements for concrete products; - types of welded joints; - types of embedded parts; - reinforcement prestressing; - shops design standards; - production process structure; - stages of technological design of concrete products; - basics of metrology and measuring tools; - safety measures and 	<p>concrete products;</p> <ul style="list-style-type: none"> - make the flow chart for the manufacture of concrete products. 	
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processing and products assembly during the manufacturing and control over all operations of technological sequencing.		environment protection measures.			
PC 3.4 Participate in drafting process maps and other technical documentation					

<p>PC 3.5</p> <p>Participate in identifying the causes of the products defects, in preparing proposals for its prevention and elimination.</p> <p>PC 3.6</p> <p>Monitor compliance with occupational safety and</p>					
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health. PC 3.7 Participate in the implementati on of advanced technological processes and optimal modes of production under the guidance of more qualified professional, thus ensuring compliance					
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with developed projects with technical requirements and applicable regulatory documents.					
PC 3.2 Monitor the compliance with the highest quality products, reduced material and labor costs	Organization, planning and management of the enterprises of building products and structures	- know domestic and foreign experience in the field of organization, planning and management of the enterprises of building products and structures	- solve specific management problems; - use independently theoretical knowledge in the process of self-study; - work with the special regulatory literature; - determine the most effective use of all the material and technical		BC 1 - BC 10

for its manufacture. PC 3.4 Participate in drafting process maps and other technical documentati on PC 3.7 Participate in the implementation of advanced technological processes and			and human resources in the production.		
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optimal modes of production under the guidance of more qualified professional, thus ensuring compliance with developed projects with technical requirements and applicable regulatory documents.					
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<p>PC 3.2</p> <p>Monitor the compliance with the highest quality products, reduced material and labor costs for its manufacture.</p> <p>PC 3.6</p> <p>Monitor compliance with occupational safety and health.</p>	<p>Automation of production processes of concrete and metal products and structures</p>	<p>- theoretical foundations of automation; - basic concepts in the field of automatic monitoring and control in the production of reinforced concrete and steel products; - essence of automatic and automated technological process systems;</p>	<p>- formulate the assignments for automatic monitoring and control of individual machines, devices and production lines on the basis of existing regulatory and technical documentation; - develop structural and functional scheme of automatic technological process control and monitoring; - define the role of automated lines at the building industry plants in improving the quality, performance, product</p>	<p>BC 1- BC 10</p>
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<p>PC 3.7</p> <p>Participate in the implementation of advanced technological processes and optimal modes of production under the guidance of more qualified professional, thus ensuring compliance with</p>			<p>manufacturing stability;</p> <ul style="list-style-type: none"> - emphasize the feasibility and socio-economic efficiency of production processes automation in the construction industry 		
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developed projects with technical requirements and applicable regulatory documents.					
PC 3.1 Prepare sketches based on the working drawings for the issue of assignments to brigades of molders and	Organization of Standardization, Certification and Accreditation in the factories of concrete and metal products	<ul style="list-style-type: none"> - standardization problems, its cost-effectiveness; - basic systems position (complexes) of general technical and organizational and methodological standards; - basic concepts and definitions of quality 	<ul style="list-style-type: none"> - use the quality systems documentation in professional work; - draw up technological and technical documentation in accordance with the current regulatory framework, based on the use of the main certification and 		BC 1- BC 10

steelfixers to perform the products manufacturing schedule. PC 3.4 Participate in drafting process maps and other technical documentation		systems standardization, certification and documentation; - terminology and units of values in accordance with the applicable regulations and international SI units system; - forms of quality assurance; - quality systems documentation; - consistency of terminology, units with the applicable regulations and international SI units system in educational	standardization provisions of production activities; - provide non-systemic measurement values in accordance with the applicable regulations and international SI units system; - apply the quality system documentation; - apply regulatory document requirements to basic products (services) and processes; - test and control products; - acceptance sampling	
on PC 3.7 Participate in the implementation of				

advanced technological processes and optimal modes of production under the guidance of more qualified professional, thus ensuring compliance with developed projects with technical requirements and		disciplines; - basic systems position (complexes) of general technical and organizational and methodological standards; - basis of product quality improvement; - knows the basic processes that require technical and laboratory control; - requirements of laws, technical regulations, GOST ISO/IEC 17025 and other RD; - types of quality control and tests.		
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applicable regulatory documents.					
Qualification Junior production engineer					
Professional modules					
PC 4.1 Carry out experimental research and design and experimental works to optimize process parameters of production and improve product	Calculations and design of reinforced concrete structures	<ul style="list-style-type: none"> - physical and mechanical properties of concrete, reinforcing steel and reinforced concrete; - features of the concrete elements 	<ul style="list-style-type: none"> - using current regulatory, technical and reference books, calculate and design basic prefabricated and monolithic concrete structures of buildings and structures; - design reinforced concrete structures; - produce strengthening and restoration of these structures 		BC 1 - BC 10

quality, introduce new technologies and products		<p>the basis of the adopted structural scheme of operating loads structures and combinations;</p> <p>- design features of main reinforced concrete structures for industrial and civil buildings and structures;</p> <p>- principles of design schemes layout of buildings and structures of precast and cast reinforced concrete;</p> <p>- basics of designing joints and connections of prefabricated elements and their</p>			
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		<p>calculation;</p> <ul style="list-style-type: none"> - basic regulatory and technical documentation on the design of reinforced concrete structures 			
<p>PC 4.1 Carry out experimental research and design and experimental works to optimize process parameters of production and improve</p>	<p>Calculations and design of metal structures</p>	<ul style="list-style-type: none"> - trends in developing constructive forms of metal structures; - calculation method of metal structures for limit states; - calculation rules for element connections nodes; - design rules for steel structures, taking into account the requirements of 	<ul style="list-style-type: none"> - choose a material for structures and their elements taking into account the requirements of design standards; - make the schemes of buildings in different shapes and layouts, develop element connections nodes; - determine the load on the structures and efforts in elements; 		BC 1- BC 10

product quality, introduce new technologies and products		manufacturing, transportation, installation and technical operation	- know to select elements cutting, test their strength, durability and rigidity	
PC 4.1 To conduct experimental research and computational and experimental work on the optimization of process parameters of production	Learning the basics of market research	<ul style="list-style-type: none"> - Principles of strategic and tactical planning; - Marketing activities; - Principles of working with the media; - Principles of budgeting and planning of marketing expert activities; - systems of measures in the resolution of crises in the organization; - principles of 	<ul style="list-style-type: none"> - set goals and formulate the tasks associated with the implementation of professional functions; - use the information obtained as a result of marketing research; - carry out a comprehensive and situational analysis of the competitive environment of the organization; - make decisions under 	<p>Systematic collection, processing and analysis of data on marketing activities;</p> <p>Assessment of the market status and trends (situation); study of consumer behavior;</p> <p>Analysis of competitors, suppliers, intermediaries; formation of sales channels and aimed use of promotional tool.</p>
				BC 1 - BC 10

and improve product quality, the introduction of new technologies and products; PC 4.2 To optimize, improve the existing production and introducing new manufacturing techniques		assessment of the effectiveness of the advertising department and public relations; - the basic laws and regulations of the RoK, regulating and governing marketing activities in the Republic of Kazakhstan - principles of preparation and presentation of materials for expert opinions and reports; - methods of evaluation and selection of innovative projects - collection and	stress and limited time monitoring; - be skilled in expert evaluation of strategic planning; - apply the methods of quantitative analysis and modeling, theoretical and experimental research; - develop and implement key marketing programs; - find ways to improve existing designs, technologies and materials in order to improve the competitiveness of products; - define ways to use the	
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of materials and structures; PC 4.3 To conduct work on certification and quality control of construction materials and structures; PC 4.5 To optimize, improve the existing production and		<p>systematization of scientific and practical information on the topic in the field of marketing, advertising and PR research.</p> <p>- methods of market observations, surveys questionnaires, experiments to improve the image and competitive position in the market.</p>	<p>latest achievements of science and technology for creating new competitive products;</p> <p>- carry out analytical work on best practices of competitors and investigation of market conjectures;</p> <p>- carry out the model developments, carry out pilot and test works.</p>		
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<p>introducing new manufacturing techniques of materials and structures; PC 4.7 To carry out work on the organization of the enterprise (and / or its business units) and management of production</p>					
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and business activities					
PC 4.1 To conduct experimental research and computational and experimental work on the optimization of process parameters of production and improve product quality, the introduction of new	Orchestration of measures for resource conservation in the production of building materials	<ul style="list-style-type: none"> - key indicators of resource conservation and cost-effective use of resources; - factors affecting natural-resource potential; - classification of technogenic waste and by-products, the main directions of their processing; - basic directions and ways of energy saving in the construction industry; - the main way to 	<ul style="list-style-type: none"> - use effectively natural resources potential; - theoretically and experimentally evaluate the possibility of using local raw materials and industrial waste in developing effective materials; - make technological schemes of progressive non-waste and low-waste production; - implement measures aimed at energy and material conservation in the production of 		BC 1 - BC 10

technologies and products; PC 4.2 To produce building materials and construction s; PC 4.5 To optimize, improve the existing production and introducing new manufacturi ng		improve production efficiency; - foundations of ecological safety in the technology of production of construction materials; - hazards of building materials at all stages of the life cycle; - principles for the selection of building materials taking into account the feasibility and environmental preferences	building materials; - assess the quality of harmonious building materials taking into account the feasibility and environmental preferences	
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techniques of materials and structures; PC 4.7 To carry out work on the organization of the enterprise (and / or its business units) and management of production and business activities					
Vocational training and professional internship					
Professional internship					

PC 2.1.1- PC 2.1.6	Industrial internship for obtaining a profession “Steel Fixer- Welder”	Workplace organization; safety rules and health regulations for welding work; properties of metals and alloys; fundamentals of metallurgical processes for welding and melting, the structure of the weld joint, welding and melting materials and equipment for welding and surfacing; basic techniques for steel welding, rules for setting welding conditions on the set	Organize rationally work in the workplace; follow the work process; comply with the rules of technical operation and maintenance of the equipment, devices and tools for work; perform the materials rate to the work performed; distinguish and evaluate the types of weld joints and the melting coatings and their characteristics; - reasonably and correctly select the welding and melting materials and types of	Follow safety rules and health regulations for welding work; welding equipment skills; metal preparation and manufacturing reinforcing products; manufacture of flat screens, bulky frames, embedded parts; work on the layout and installation of templates, jigs; production of edge, selection electrodes, tack welding.	BC 1- BC 10
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		parameters, the main defects of welded joints and their causes; types of modern welding equipment, design and rules of operation, sources of supply; - welding safety of and environmental protection measures	welding and melting in order to ensure a quality jointing of details; keep a safe and hygienic working methods, basic means and techniques for prevention and fire fighting in the workplace.		
PC 2.2.1- PC 2.2.8	Industrial internship for obtaining a profession “Moulder-Concreter-hookman”	Rules of safety and industrial hygiene in production facilities for the manufacture of concrete and metal products; various types of construction materials and their properties;	Follow safety regulations and industrial hygiene in production facilities; optimize and use the machines, tools and equipment for the production of reinforced concrete structures; choose the necessary	Working knowledge of the mixing equipment with dosing and conveying devices; knowledge of determining the main properties of the concrete mix.	BC 1- BC 10

		<p>features of production and application, the relationship of composition, structure and properties of building materials; basics of concrete practices and obtaining concrete with desired properties;</p> <p>basic technological processes: preparation of concrete mixes, concrete forming different concrete structures and their thermal treatment, as well as production control;</p>	<p>materials for concrete, determine their suitability, determine the basic properties of concrete and other materials taking into account the requirements of regulatory documents.</p>		
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		<p>equipment for the transportation and storage of materials, equipment for dosing and mixing materials; rules for the transportation of concrete mixtures; basics of metrology and measurement tools.</p>			
<p>PC 3.1- PC 3.7</p>	<p>Industrial internship (by specialty)</p>	<p>Familiarization with the production management; induction training; familiarization with the place of internship, instruction for safety and fire protection in the workplace;</p>	<p>Perform accounting documentation for the performance of work; processing and registration of technical documentation and procedures of its preparation; prepare sketches on the</p>	<p>Fill up and prepare reports for the performance of work; processing and recording technical documentation and procedures for its preparation; preparation of sketches based on working</p>	<p>BC 1- BC 10</p>

	reporting documentation for execution of works; processing and recording of the technical documentation and procedure for its drawing; drawing up process charts; preparation of sketches based on working drawings; safety advice; transportation of goods; the use of machinery and equipment, testing and delivery of the finished product to warehouse	basis of working drawings; perform calculations on the selection of the composition of concrete for various purposes; select concrete compositions of specified quality; develop the technological scheme of production of concrete products; prepare the technological card for manufacture of concrete products.	drawings; perform calculations on the selection of the composition of concrete for various purposes; production of concrete and metal products upon process charts.		
PC 3.1- PC	Technological	General introduction to	Read the working	Carry out the work within	BC 1- BC 10

3.7	the enterprise for the production of concrete and metal products; familiarization with the place of internship; study of production technology in the workplace on the main profession; work in the workplace as part of the production team; supply chain management of work performed.	drawings, cost estimates, work performance project, monitor their use by teams for the organization and control of work, registration of applications; draw up technical documentation used in the production of works (work logs, acts of acceptance, etc.); control the types of work performed by a team, schedules, documentation, used for organization of work, including the operational quality assurance	the obtained working profession (with appropriate preparation and by related professions); guide the work of the working units (brigades), ensuring compliance with established rules of labor protection, fire protection and environmental protection; read fluently the project documentation and use it during the work; issue permits to work, prepare acts on the hidden works, prepare reports.	
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PC 4.1- PC 4.10	Pre- graduation internship	Familiarization with the production management; induction training; familiarization with the place of internship, instruction for safety and fire protection in the workplace; reporting documentation for execution of works; processing and recording of the technical documentation and procedure for its drawing; study of the rights and obligations of the	schemes. Documentation development using professional information systems; development of production process of concrete and metal products; implementation of production process; maintenance of process equipment; monitoring the production process; analysis of defects and defective products with the development of measures to prevent	Development of technological processes of production, processes of technological preparation of production, construction products using computer- aided design (CAD); prepare the process charts to all stages of the production of reinforced concrete and metal products; organization of products manufacturing process; technological calculations of equipment, consumption of raw materials;	BC 1- BC 10
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		<p>foreman; organization of labor within the team, pay workers, engineers and technicians; rules for the development, design and reading of design and technological documentation; purpose and types of technical documents; methodology of designing the technological process of manufacturing of products; principles, forms and methods of organization of production and</p>	<p>them; production planning within the structural unit.</p>	<p>product quality conformance inspection; participation in the planning of the structural unit works participation in the management of the structural unit analysis of the process and results of activity of the structural unit</p>	
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6. Content of educational programs (modules)

Steel Fixer-Welder

BGPM.00 Basic general professional modules

BGPM. 01 Transportation of various cargos

Purpose:

To develop the abilities and skills to carry out the transportation of goods of different kinds, and to work with removable lifting devices.

Tasks:

To apply for this the knowledge of normative and technical documentation and knowledge obtained during the study of special disciplines.

Introduction to module:

The module BGPM.01 "Implementation of various cargos" is a basic level and it is represented in the structure of the basic professional educational program on a specialty 1413000 "Production of concrete and metal products (by type)" in a series of general professional modules for qualifications "Steel Fixer-Welder", "Moulder-Concreter-Hookman".

For mastering the module by students it is necessary to use the knowledge, skills, formed in the course of the study of disciplines such as "Electronics", "Construction Drawing", "Transportation of various cargos", "Lifting body, removable handling devices and containers", "Health and Safety" as well as the study of normative-technical documentation (GOST, TU) while receiving the main special education.

Acquisition of the module is a necessary foundation for further study of general professional and professional modules:

BGPM .02 Laboratory tests for quality control of materials and products

BGPM. 03 Quality control of reinforcement and metal products and structures

BGPM .04 Quality control of concrete products

PM. 01 Production of reinforcement products

PM. 02 Production of reinforcement and metal structures

Content of module:

Section 1.

The direct current. The electric current. The concept of electric current. The current density. The electric circuit: definition, classification, designation and denotation of the electrical circuit elements. The resistance and conductivity of the conductors. The resistance dependence on the temperature. Ohm's law. EMF. Ohm's law. The conductor connection: series, parallel, combined. The first law of Kirchhoff. The operation and capacity of the electric current. The connection of elements: series, parallel, combined. The control and protection equipment. The concept of a short circuit. Fuses: classification, principle of operation and application. Circuit breakers: purpose, scheme, principle of operation.

Practical work No 1 . Calculation of the circuit parameters. Calculation of conductor cross-section depending on the capacity of the electric power receiver.

The alternating current. AC characteristics. Characteristics: period, frequency and phase. Their dimension and definition. The effective value of the AC. The impedance in the AC circuit. The impedance in AC circuits: types (active, inductive, capacitive), characteristics, dimension and definition. Calculation of the AC circuit. The parallel connection of inductive and capacitive impedance. The determination of total impedance. AC Power. Power factor.

Three-phase alternating current. The generation of three-phase current, its properties. The wye connection. The delta connection. The capacity of three-phase current.

Practical work No 2 . Calculation of three-phase circuit parameters.

Transformers. Purpose, design, operating principle of the transformer. Operating modes: idle and operating. Features of design and operation of three-phase transformer. Symbols. Efficiency and power.

Electrical measurements. Classification of electrical devices. Symbols. Purpose. The measuring principle of electrical quantities: current, voltage, impedance measurement, insulation measurement, power measurement.

Laboratory work No 1. Measurement of electrical quantities using amperemeter and voltmeter.

Electric machines. Generators. Electric machines: purpose, classification. Electric generators: classification, design and principle of operation, characteristics, efficiency. Electric motors.

The classification, design, operating principle, characteristics, efficiency.

Section 2.

General information on the construction drawing. Requirements for a Unified Design Documentation System and System of Design Documentation for Construction. Basic rules of drawings and schemes, types of normative and technical documentation. Types of construction drawings, projects, circuit diagrams. Project stages. Marking of working drawings. Drawings of buildings: facades, plans, sections. General plan.

Interpretation of general architectural and construction drawings

Interpretation of drawings for masonry structures of buildings

Interpretation of drawings for reinforced concrete structures

Practical work No3. Drawings of reinforced concrete structures

Interpretation of drawings for panel and large-block buildings

Interpretation of drawings for metal structures

Practical work No4. Drawings of metal structures

Interpretation of drawings for the sanitary systems

Section 3. Transportation of various cargos. General information about the production.

The importance of industry in the national economy for which the preparation of

slingers is carried out,. Outline of the production process and equipment in this production area. The importance of the hookman profession and its development prospects. Location of facilities (objects) in the territory of the enterprise (organization). The role of the professional working skills to provide the highest quality of work.

Safety requirements, industrial hygiene and environmental protection at production site.

General information about the system of labor safety standards. The provisions of the Labour Code and other legal acts that define the labor process and production specifics. General information on state supervision, internal departmental and public control over the production. Administrative and legal responsibility of production managers and citizens for violations in the field of environmental management and environmental protection. The concept of the industrial botany and production ecology. Internal labor rules and regulations. Rules of conduct of workers in the workplace. The procedure for obtaining, use and storage of tools, appliances, etc, as well as the procedure for the use of machinery and equipment. Dangerous and harmful production factors and causes of industrial accidents. The concept of occupational injuries and diseases. The basic methods and means of prevention of accidents and occupational diseases. Requirements to manufacturing equipment and manufacturing processes in occupational safety standards systems. Safety devices, fencing and signaling colors and safety signs. The key measures to prevent electrical accidents. Rules for safe working with electrified equipment and tools. Information about electrical installations grounding. The basic hygiene factors of the industrial environment. Evaluation of technologies and equipment for ecological continuity. The possible contamination of atmosphere, water, land during transportation, moving of cargo by lifting machines and their storage. Means of individual and collective protection of workers. Clothing, footwear, hand, respiratory, head, eye and face protection. Safety devices. The order of selection, fit and use. Marking and testing protective equipment. Methods for storage and maintenance in operational condition of protective equipment. Fire, gas, chemical, biological and other hazards in the workplace. Occupational safety standards, rules and instructions on work safety. The main causes of occupational hazards and general information about its prevention. The primary means of preventing hazards, rules for using them. Actions of workers in the event of dangerous situations at production site. Medical care in the company (at the site). Methods of rendering first aid in the production in case of electric trauma, mechanical injuries, poisoning, eye injuries, thermal burns, burns, acids, alkalis, etc. The contents of first aid kits in the production and procedure of their use. The order of notification of the management in case of accidents or industrial accidents. The workers' benefits and compensation for special working conditions (in relation to the profession and the specific conditions of production).

Overview of lifting cranes. Classification of cranes by type of coder, working equipment, and drive. The main types of hook suspension of cranes. Scope of cranes. Indexing lifting cranes. Lifting cranes characteristics. The requirements of the rules of the need to consider the size of the crane lifting capacity, mass of removable lifting devices. The permissible proximity limit of cranes to buildings, piles, and vehicles. Safe places for the passage of people, movement of transport, exits from buildings to meet the working zone of cargo movement. The need for signaling the crane operator to stop works on the appearance of people in the work area. Lighting

and signaling system on cranes. The working movement of the crane, the combination of working operations, the crane stop (off) on the emergency signal (stop). Emergency lowering of the cargo transported.

Organization of the safe operation of lifting equipment. General characteristics of the lifting and transporting equipment at the production site. Classification and scope of various lifting and transporting equipment.

Group of lifting equipment and the general requirements of "Rules for Design and Safe Operation of Cargo Cranes". Information on the design, instruments and safety devices, brakes and control devices. The concept of the technical specifications and the basic parameters of load-lifting machines, their design features (hoist, overhead crane, bridge crane or bridge type / jib-type and self-propelled crane, tower crane, gantry crane, etc.).

Supervision of the safe operation of lifting equipment, loose lifting gear and containers. Obligations of the company's management (organization) to ensure the proper condition of machinery and equipment belonging to the enterprise. The contents of the instructions for professionals and individuals associated with the operation and maintenance of lifting equipment. The contents of the instructions of hookman at the production site.

Requirements for the training of specialists and workers associated with the operation of lifting equipment. The procedure for a medical examination, assessment, periodic inspection of the knowledge of responsible persons and staff in accordance with the "Rules for Design and Safe Operation of Cargo Cranes".

The procedure for permit to work of the experts as persons responsible for the safe operation of lifting equipment, loose lifting gear and containers, as well as the service personnel (hookman, crane operators, mechanics, etc.). The responsibility of employees for violation of rules and regulations.

The order of registration, technical inspection and authorization for operation of lifting equipment at the production site. General information about the repair of load-lifting machines, loose lifting gear and containers. The technical documentation required for the safe operation of lifting equipment, loose lifting gear and containers. Persons responsible for the maintenance and storage of documentation. Lifting bodies loose lifting gear and containers. General information on loose lifting gear (slings, beams, grips). Classification of lifting devices. Range of use at the production site. The requirements of "Rules for Design and Safe Operation of Cargo Cranes" for loose lifting gear (manufacturing, testing, labeling, the procedure of calculation and application, maintenance and rejection of defective parts). Information materials of technical supervision authorities in relation of the manufacture and rejection of loose lifting devices. Design and operation of loose lifting gear.

Overview of elements of loose lifting gear (steel, hemp, cotton, synthetic ropes, welded anchor chain, etc.). Steel ropes. Constructive types, symbols. Ways to connect the ends of the ropes (splicing, cotter joint with sleeve, pressing with sleeve, etc.). Knots of various ropes. Influence of joints direction in the form of lay (cross rope lay, bang's lay) on the knot design. Requirements of "Rules for Design and Safe Operation of Cargo Cranes" for methods for connecting the ends of the ropes.

Overview of the load in the branches of slings depending on the angle of slope to the vertical. Concepts on the calculation of steel ropes of loose lifting gear and rope safety factor. Bending of steel and other ropes. Influence of relationships on the safety and durability of steel ropes. Selection of diameters of branch and pulley

blocks, as well as joints when binding sharp-edged cargo.

Design of hemp and cotton ropes used in the production of slings. Scope of them. Maintenance and storage.

Chains used in loose lifting gear (uncalibrated, short-link, welded). Maintenance and storage. Methods of connection. Other removable attachments flexible elements (tows, etc.). Application and Maintenance.

Signs and grading standards flexible elements of loose lifting gear (steel and other ropes, chains, etc.). Requirements of Rules for rejections of steel ropes and chains.

Slings and their types. Components of loose lifting gear (thimbles, hooks, cams, grabs, hinged units, blocks, etc.). Influence of thimbles on the strength and reliability of the ropes when using a sling.

Hoisting elements (hooks, carabineers, etc.). Types and scope of use. The closing devices on hooks of slings. Design of closing devices ensuring quick and safe operation of loose lifting gear.

Special devices of loose lifting gear (balancer blocks hydraulic downender, etc.). Design features, scope of use, maintenance procedure.

Signs and rejection rate of all components of loose lifting gear.

Traverses (flat and volumetric). Design variations, the order of manufacture, range of applications. Signs and rejection rate of traverse at the production site. Hooks (slip, clamp, eagle, etc.). Variety, range of applications. Signs and rejection rate of hooks at the production site. Clips, hooks, and other specialized devices and tools for moving cargo by hookman using lifting equipment. Scope of their use, maintenance and rejection rate at the production site.

Hook suspension of lifting machine. Varieties and design features. Requirements to hooks and hook suspension. Container. Industrial container. Safety requirements in the operation of container. Procedure for the manufacture, testing, marking and maintenance of containers according to the requirements of the Rules. Scope of use of various types of containers and their storage. The procedure for rejection of container at the production site.

Types and methods of cargo slinging. Characteristics and classification of transported cargos (for this industry). The selection of lifting devices depending on the weight of the cargo. Determining the mass of cargo upon documentation (the list of cargo mass). Determining slinging places (hooks for graphic images). Procedure to provide a hookman with lists of masses of cargo transported by cranes. Main slinging types: hooks joints, double wrap or fastening, loop the loop (choker hitch).

Analysis of examples of graphics methods of slinging and moving cargos. Study of safety posters.

Personal safety of slingers when slinging and lifting cargo to a height of 200-300 mm for validation of slinging. Prohibition for correction of slinging (eliminate tilt load) in the air, getting to the edge of the stack or the ends of inter-packet gaskets, use a crane to lift the people on the stack or to lower. Compliance with personal safety of slingers during cargo slinging.

Cargo storage in open areas in the territory of the shop, centre of cargo handling. Permissible dimension of stock-piles, walkways and passages between the stock-piles (based on safety regulations). Slinger's reporting directly in the performance of work to the person responsible for safe movement of cargo by cranes.

Study of the "Instructions for safe operation for the slingers (hookman) serving cargo cranes; rights and duties of slingers, order of work performance, guidance

for personal and general safety for maintenance of cranes, which are subject to the "Rules of design and safe operation of cargo cranes". The procedure for issuing the "Instructions" for slingers. Responsibility for violation of the guidelines set forth therein.

Duties of the slinger before starting work: the selection of lifting devices, appropriate to the weight and circuit of cargo slinging to be moved by cranes over the norm; checking the lifting devices and the availability of stamps or labels on them with the designation of a number, test date and cargo capacity; workplace inspection. Responsibilities of the slinger when fastening and hooking cargo: receipt of the task; action in case of unclear task received, inability to determine the mass of the load, no slinging schemes, constrained and cargo froze to the ground; inspection of cargo weight based on the description or marking that intended to move; cargo hooking without knots, twists and loops using supports under the edges in slinging places; meeting the requirements to exclude falling out parts of unitized cargo and ensure its stable position while moving; cargo hook for all the loops, pins, holes provided for this purpose, strengthening the unused slings of lifting devices.

Responsibilities of the slinger when lifting and moving cargo: signaling the crane operator of the beginning of each lifting and moving the cargo; checking the reliability of fastening of the cargo and lack of its jaggings; removal of loose parts and other items from the cargo; cargo perimeter inspection; places between the cargo and the walls, columns, stock-piles, equipment, boom-down zone, advanced signal to rise to 200-300 mm of the cargo, weight of which is close to the permissible carrying capacity of the crane. Check the correct slinging, sling tension uniformity, stability of cranes and operation of the brakes. Checking the capacity of crane before lifting the cargo. Visual determination of clearance of at least 0.6 m between the raised load and objects occurring in the way of the horizontal movement ; cargo support during its movement and the use of special braces to prevent inadvertent reversal of long and bulky cargos; stowage of cargo without violating the established storage standards. Signaling the operator in the event of crane or crane runway malfunction.

Responsibilities of the slinger when lowering cargo: site survey, on which the cargo can be lowered, and the definition of the impossibility of its falling, tilting and slumping, laying on the location of cargo the supports for easy removal of slings under it, removal of slings from the cargo. Slinger's rights: suspension of cargo slinging the weight of which is unknown or exceeds the carrying capacity of the crane; replacement and removal from the workplace damaged or unlabelled lifting devices; termination of strapping and cargo hooking in other ways than shown on the slinging schemes; failure to produce strapping, hooking and hanging cargo on the crane hook, located closer than 30 m from the extreme wire transmission line without the work-permit, and the absence of a responsible person appointed by order of the company, whose name should be specified in the work-permit; termination of lifting and moving cargo, if people are on it or under it; suspension of work before finding the person responsible for the safe operation of placement of cargos by cranes, order for fulfillment of operations for cargo slinging in high winds, fog, and rainy weather.

Performance of works. General information on the content of the draft of works with lifting equipment or process chart for cargo movement at this production site. Signaling system between the slinger and crane operator at work.

The concept of hazardous areas at the production site, at work of lifting and other

machines and movement of cargos. Indications of danger zones.

Information about installing the different types of lifting equipment at the enterprises and open facilities. The concept of the stability of boom-type cranes. Dimensions of cranes to buildings, to the slopes of trenches, to each other, etc.

Requirements of Rules during:

- Installation and operation of jib-type cranes up close and in the protection zone of overhead power lines;
- Operation of several cranes on the cargo movement;
- Installation of jib and tower cranes at the slopes of trenches;
- Movement of cargos over the floors of industrial and office facilities;
- Supply of cargos into openings of buildings the open and hatches of the ceiling.

Organization of handling operations at the production site. Safety requirements for handling operations.

General information about the storage of goods in manufacturing. Technical terms and conditions for cargo storage. Walkways, scaffolding while working on the territory of the warehouse. The procedure for lifting, moving and placing cargo on a prepared place. Dangerous practices in working with cargos as the cause of accidents and breakdowns.

The procedure for the investigation of accidents at the production site when moving cargo.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO1 Know different ways of cargo transportation by means of special lifting devices</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - предельные нормы нагрузки крана и стропов; - Schemes of slinging, lifting and movement of small cargos; - Lifting points of typical products; - Conditional signaling for crane operators (crane driver); - Purpose and rules of slings, chains, ropes, etc.; - Limits of crane loads and slings; <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Carry out strapping and hooking simple products, parts, light, and other similar cargos for their lifting, movement and stowage; - Perform detachment of slings on place of installation or stowage; - Choose the appropriate slings according to weight and dimension of transported cargo; - Determine the suitability of the sling; - Give signals to the crane operator (crane driver) and monitor over the load when lifting, moving and stacking; - Timely and efficiently prepare and clean the workplace; - Prepare equipment, tools, appliances for work and keep them in good condition, accept and pass the shift; - Comply with safety rules and internal code of conduct; - Use, if necessary, means of preventing and fighting fires in the workplace, site and other means of preventing hazards; - Provide pre-hospital medical assistance to the victims at the production site.

BGPM. 02 Carrying out laboratory tests for the quality control of materials and products

Purpose:

This module will give students an understanding of the relationship of technical requirements specified in the regulations for manufactured products and the properties of the raw materials in the production of concrete products and structures. Ability to apply knowledge of the physical and mechanical properties of materials, forecasting the final result.

Tasks:

To prepare a specialist able to effectively solve practical problems, to more fully understand and apply the principles of metrology, analyse the results obtained, as well as contribute to the further development of the individual.

Introduction to module:

The student should understand that the quality of the materials affects the final result of the production; should know the test methods and be able to work with the test equipment. The student should have an idea of testing laboratory accreditation, know the law on accreditation and related requirements of GOST ISO / IEC 17025, participate in the development of the laboratory enterprise control scheme (or in its improvement). Mastering the module is a necessary foundation for further study of general professional and professional modules:

BGPM .01 Transportation of various cargo

BGPM. 03 Quality control of reinforcement and metal products and structures

BGPM .04 Quality control of reinforced concrete products

PM. 01 Production of reinforcement products

PM. 02 Production of reinforcement and metal structures

Content of module:**Section 1.**

The concept - the scope of accreditation. The accreditation body. Types of inspection: incoming, operational. Incoming inspection - quality control of incoming materials and semi-finished products.

Operational control - quality control of the concrete mix, concrete strength - stripping, handling, design. Production of concrete samples, the quantity and conditions of storage.

Section 2 .

The concept of "concrete grade" as a statistic value. Calculation of coefficient of variation.

Developing dosages of concrete mix from existing material or concrete mixture of the desired properties.

The development of modes of heat treatment or curing of concrete and concrete products.

Test equipment and requirements thereto. The concepts of verification and calibration. Calibration laboratories.

Non-destructive testing methods. Building dependency. Defectoscopy. Study of the Law "On Technical Regulation", the Law "On Accreditation", the Law "On the unity of measurements", technical regulations, GOST 17025.

Statistical methods for data processing.

Collation test, inter-laboratory tests.

Laboratory testing documentation.

Section 3 .

Selection of chemical additives to solve technological issues, reduce the cost of heat treatment or curing, increase reuse of forms, improving the properties of the

concrete mix and concrete. Monitoring the implementation of the use of technology of chemical additive in concrete mixture at the concrete mortar shop. Occupational health in carrying out monitoring in the shops and in the performance of laboratory tests.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO2 Know various methods of laboratory tests for the quality control of materials and products.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - Types and methods of control; - Basic technological processes that require technical and laboratory control; - Legal requirements, technical regulations, GOST ISO / IEC 17025 and other regulatory documents; - Types of technological schemes and features of quality control in the production of concrete mixtures, reinforcement products, concrete products and structures; - Laboratory equipment and its requirements; - Kinds and types of measuring instruments, requirements of GOSTs; - Statistical methods of control results processing; - Requirements for the conduct of laboratory documents and records. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Use test equipment and measuring instruments; - Distinguish and evaluate the quality of concrete mixes and make corrective actions; - Use statistical methods to assess the quality of materials; - Choose a method of control and use both the destructive testing methods and non-destructive testing methods. - Carry out adjustments to the concrete mixture - Choose the mode of heat treatment according to the durability requirements for reinforced concrete structures and, if necessary, readjust it; use the heating equipment; - Extract the necessary information for testing of reinforced-concrete, concrete, reinforced products from the drawings, GOST, ST RK, projects, regulatory documents for test methods

BGPM. 03 Quality control of reinforcement and metal products and structures

Purpose:

This module will give students an understanding of the relationship of technical requirements specified in the regulations for manufactured products and the correctness of conducting the technological processes in the production of reinforcement and metal products and structures.

Tasks:

To prepare a specialist able to effectively solve practical problems, to more fully understand and apply the principles of metrology, analyse the results obtained, as well as contribute to the further development of the individual.

Introduction to module:

The student should understand that failure to comply with all the technological processes, or their violation will result in the production of products with defects which can not only lead to economic loss, but also loss of life. The student should distinguish between different levels of quality control, be able to use the regulatory instruments and measuring instruments. Just knowing the "narrow" places of production technology used the student should provide the necessary operational control scheme. The student should know and be able to carry out the quality management system requirements of ST RK ISO 9001. Mastering the module is a necessary foundation for further study of general professional and professional modules:

BGPM .01 Transportation of various cargo

BGPM. 03 Quality control of materials and products

BGPM .04 Quality control of reinforced-concrete products

PM. 01 Production of reinforcement products

PM. 02 Production of reinforcement and metal structures

Content of module:**Section 1.**

The control over the compliance of materials with the project, specifications and national standards of raw materials. Analysis of information on incoming materials contained in the accompanying documents. Analysis of test results obtained by the plant laboratory.

The control over the supply of metals, especially of business waste to the processing.

The control over the parts and semi-finished products precision.

Monitoring compliance of assembly plants with the projected technology.

The control over the conformity of the finished product with drawings and specifications. Products are considered to be finished when all the operations inherent in this shop are made in terms of fully and consequently drawing and specifications. For example: assembly and welding or riveting and assembly.

Features of the quality control of complex structures and structures with nodes, which will be impossible to check after the fabrication of structures.

Section 2.

Tools for monitoring, requirements to them. Study of the Law "On Technical Regulation", the Law "On the unity of measurements", the Law "On the accreditation of conformity assessment", technical regulations, ST RK ISO 9001, GOST 26433. Permits to assembly of structures, and regulatory documents.

Requirements to the acceptance of welding joints, control of welding technology. Compliance of the qualification of the welder with works performed. Visual inspection. Methods for the establishment of full penetration welding.

Methods for establishing the actual mechanical strength. Methods of acceptance

by quality of vessels.

Quality control of riveted joints. Control over the accuracy formation of the mounting holes, deviation of milling surfaces. Control of protection against corrosion of metal parts and structures.

Preparation of the document on the quality, the intermediate acts of acceptance in accordance with the quality management system. Occupational safety when performing control in assembly plants and finished products acceptance.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO3 Know the basic quality control methods of reinforcement and metal products and structures.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - Properties of metals and alloys, methods of their study, the prospects for the development of materials; - Basic technological methods of welding steel, rules of installation of welding modes on the set parameters, the main defects of welded joints and their causes; - Requirements of laws, technical regulations and other normative regulations; - Types and schemes of quality control in the manufacture of reinforcement and metal products and structures; - Particular methods of acceptance of non-standard metal structures; - Requirements and permits for welding of any kind; - Levels of complexity of the work and qualifications of welders, admitted to the various types of welds; - Kinds and types of measuring instruments, requirements of GOSTs; - Methods of acceptance of reinforcement and metal products and structures; - Requirements for the preparation of documents on quality; <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Use measuring instruments; - Distinguish and evaluate the importance of defect found in reinforcement and metal products and structures, the possibility of its correction; - Use the table of tolerances, reference books; - Work on equipment that produces testing of reinforcement and metal products and structures; - Control the size of the templates, conductors - Extract the necessary information from the drawings, GOST, ST RK, projects. - Collect and process statistical data (analysis) - Decide on the conformity (or otherwise) of products (the raw material, components, etc.) with the requirements of normative documents, specifications, drawings, designs

BGPM. 04 Quality control of reinforced-concrete products

Purpose:

This module will give students an understanding of the relationship of the system of technical requirements stipulated in the normative documentation for manufactured products and the correctness of the technological processes in the production of reinforced-concrete products and structures.

Tasks:

To prepare a specialist able to effectively solve practical problems, to more fully understand and apply the principles of metrology, analyse the results obtained, as well as contribute to the further development of the individual.

Introduction to module:

The student should understand that failure to comply with all the technological processes, or their violation will result in the production of products with defects which can not only lead to economic loss, but also loss of life. The student should distinguish between different levels of quality control, be able to use the regulatory instruments and measuring instruments. Just knowing the "narrow" places of production technology used the student should provide the necessary operational control scheme. The student should know and be able to carry out the quality management system requirements of ST RK ISO 9001. Mastering the module is a necessary foundation for further study of general professional and professional modules:

BGPM .01 Transportation of various cargo

BGPM. 02 Carrying out laboratory tests for the quality control of materials and products

BGPM. 03 Quality control of reinforcement and metal structures

PM. 01 Production of reinforcement products

PM. 02 Production of reinforcement and metal structures

Content of module:**Section 1.**

Types of inspection: incoming, operational and acceptance. Incoming inspection - quality control of incoming materials and semi-finished products. Operational control - control of certain operations in accordance with the modes, instructions, maps. Acceptance inspection - compliance of reinforced-concrete products with technical regulations, standards and specifications. The concepts of continuous random, inspection, and conditions of their use.

Section 2.

Quality control of metal molds, molding tracks, pallets, lubricants, the assembly of metal forms. Control of embedded parts, reinforcement products. Control of reinforcement, prestressing, embedded parts, fixing frame in shape. Check the conformity of the finished product with drawings and specifications. Checking the strength, hardness, fracture toughness according to GOST 8829

Tools for inspection, requirements to them.

Section 3.

Study the Law "On Technical Regulation", the Law "On the unity of measure-

ments”, technical regulations, ST RK ISO 9001.

Acceptable deviation of all types of structures specified in GOST 26433 and regulatory documents.

Statistical methods for data processing.

Production control documentation.

Marking of products.

Preparation of a document on quality, intermediate acceptance acts.

Occupational health in carrying out inspection in the shops and at acceptance of the finished product.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
LO4 Possess the basic quality control methods of reinforced-concrete products and structures	KNOW: <ul style="list-style-type: none">- Types and methods of inspection;- Basic technological processes that require technical control;- Requirements of laws, technical regulations and other regulatory documents;- Types of technological schemes and quality control especially in the production of reinforcement products, reinforced-concrete products and structures;- Requirements and tolerances to reinforcement products and reinforced-concrete products;- Kinds and types of measuring instruments, requirements to them that specified in GOSTs;- Statistical methods of results processing;- Requirements for the preparation of documents on quality. BE ABLE TO: <ul style="list-style-type: none">- Use measuring instruments;- Distinguish and evaluate the importance of the defects found in the concrete products and structures, the possibility of correcting them, in conjunction with the technologist and foreman to develop and produce a corrective action;- Use tolerance tables;- Process control results using statistical methods;- Calculate the load on the reinforced-concrete products and arrange a test of strength, hardness, fracture toughness;- Extract the necessary information from the drawings, GOST, ST RK, projects for the production of reinforced-concrete products

PM.00 Professional modules

PM. 01 Production of reinforcement products

Purpose:

To generate among students a system of theoretical and practical knowledge in the field of metallurgy and welding practice, able to effectively address the practical

problems of the production of reinforcement products for reinforced-concrete structures, as well as contribute to the further development of the individual.

Introduction to module:

This module will give students an understanding of the value of reinforcement in the reinforced-concrete structure; knowledge of the properties of metals and alloys, methods of their study; possession of ways of cutting, bending, binding reinforcement, knowledge of basic technological methods of welding steel, rules of installation welding conditions on the set parameters, the main defects of welded joints and their causes; the ability to navigate in the types of modern welding equipment, its structure and rules of operation, the power supplies.

Content of module:

General information about reinforced concrete. Methods for cutting, bending, tying reinforcement steel. Basic laws of formation of structure and properties of all groups of industrial steel and alloys. Corrosion processes, formation and changes in the structure and properties of the alloys, structural evaluation of the strength of metals and ways for its improvement, the methodology and principles of materials selection for specific parts and products. Preparation of reinforcement (parts) for welding, selection and a justification of the mode and technology. Coherence and justification of s welding joints, heat treatment of details. Characteristics of reinforcement steel used for the production of reinforced-concrete products. Types of reinforcement used in the manufacture of reinforced-concrete products.

Laboratory work No 1. Defining elongation and ultimate strength of the reinforcement steel. Quality control by a methods of geometric measurements. Occupational safety in the performance of cutting, bending, welding.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO1 Possess the theoretical knowledge and practical skills in manufacturing of reinforcement products.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - Properties of metals and alloys, methods of their study, the prospects for the development of materials; - The basics of electrical engineering, necessary for working with electrical equipment; - Requirements of the Unified Design Documentation System and System of Design Documentation for Construction; - Basic rules of construction of drawings and schemes, types of normative and technical documentation; - Types of construction drawings, designs, production work schemes; - Rules of interpretation of technical and technological documentation; - Types of production documentation; - Basic technological methods of welding; steel, rules for installation of welding conditions on the set parameters, the main defects of welded joints and their causes; - Types of modern welding equipment, design and rules of operation, sources of power; - Equipment for cutting, bending, tying of reinforcement steel; - Major technological techniques of reinforcement cutting, bending; - Safety of the reinforcement works; - Environment protection <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Prepare the equipment for work; - Use electrified equipment; - Distinguish and evaluate the type of welds and the melted surfaces and their characteristics; - Choose a reasonable and correct welding and melting materials and types of welding and melting in order to ensure a quality connection of details; - Interpreter the working sketches, drawings, work performance diagrams and comply with their requirements; - Work on equipment that produces cleaning, cutting, welding, tie of reinforcement; - Work with templates, conductors; - Apply the safety rules for the production of works

PM. 02 Production of reinforcement and metal structures

Purpose:

To generate among students a system of theoretical and practical knowledge in the field of metallurgy and welding practice, able to effectively address the practical problems of production of reinforcement and metal products, as well as to contribute to the further development of the individual.

Introduction to module:

This module will give students an understanding of the properties of metals and alloys, methods of their study; know the fundamentals of metallurgical processes for welding and melting, the structure of the weld joint, welding and melting materials and equipment for welding and melting; know the basic technological methods of welding steel, rules for installation of welding conditions on the set parameters, the main defects of welded joints and their causes; be able to navigate in the types of modern welding equipment, its structure and rules of operation, the power supplies.

Content of module:

Welding practice. Fundamentals of technology of assembly and welding of steel structures. The main parameters of welding and cutting modes. Fundamentals of safety at work with welding equipment. Theory of welding processes. Classification of welding types. Characteristics and features of welding processes. Energy sources for welding. Features of influence of shielding gas and electrode coatings on the welding arc. The distribution of heat in solids under the influence of the thermal welding cycle. The main criteria for assessing the weldability of industrial alloys.

Theoretical Mechanics. Allowable stresses. Factors determining the amount of allowable stresses for the basic material and welded joints. Methods for determination of basic mechanical characteristics that determine the strength of materials.

Materials Science. The structure of solids. The structure of iron-carbon alloys, their structure depending on the temperature and carbon content of the impact. Marking steels.

Technology and equipment for arc welding. The main parameters of welding conditions.

The technology of automated welding production.

Laboratory work No 1 Manual arc welding.

Laboratory work No 2 Automatic arc welding.

Laboratory work No 3 Gas-shielded arc welding.

Laboratory work No 4 Electrical resistance welding.

Laboratory work No 5 Welding of reinforcing steel for installation of reinforced concrete structures (tub welding).

Laboratory work No 6 Gas welding.

Power supply sources for welding. The structure of welding rectifiers and transformers. Current-voltage characteristics of the conventional welding rectifiers and transformers.

Classification of weld structures. The role and place of production of welded structures in the manufacture of reinforced-concrete and metal products. Principles of classification of welded structures. Materials for the manufacture of welded structures. Details for the manufacture of welded structures. Welding consumables. Metals weldability. Characteristics, organization and structure of the production of welded structures. Nomenclature of fabricated structures.

Production type. Estimated range of structures manufactured by plants. Production type dependence on product range.

The composition of the plant. Transport-technological scheme of the plant. Characteristics of types of production. Process Flow Diagram of welded structures.

The structure of primary and secondary production of steel structures plant. Fundamentals of parts production. Influence of the type of details on the complexity of the production of welded structures. The complexity of parts manufacturing. Influence of seriality and constructive-technological features of products on the complexity of parts manufacturing. The dependence of the labour density on the complexity of the structural form and the number of parts. Cycles of structures manufacturing.

Blank production. Leveling and cleaning of rolled products. Types of metal bending equipment used. Typical tools for measuring deformations. Shot-blasting and shot blasting. Chemical cleaning methods. Metal marking. Equipment for marking. Marking in the individual and small batch production. Mechanical cutting of metal. Cutting on shears, equipment used. Oxygen, plasma and laser cutting of metal for welded structures. Shaping and milling. Equipment for the shaping and milling of parts in the blank production. Tools for checking the accuracy of machining.

Bending. Equipment for bending. Sheet steel rolling on plate-bending rolls. Ring bending of profiled steel. Bending of profile bars. Bending using presses and dies. Design of technological processes of manufacturing of welded structures. Technical specifications for the manufacture of welded structures. Manufacturability of welded structures. General principles for design of technological welding processes. The procedure for the development of technological process of manufacturing a welded structure. Normative documents on welding processes.

Equipment for assembly of welded structures. General information on assembly and welding fixtures. Types of assembly. Basing prismatic and cylindrical parts during assembly. Assembly and welding equipment group. Requirement to assembly and welding fixtures. Manual adjustment elements; permanent and removable. Mechanized devices. Air-operated holdback. Pneumocylinders - single- and double-acting. Membrane air-operated holdback. Hydraulic clamps, advantages and disadvantages. Hand, wedge, lever and eccentric clamps. Portable assembly jigs.

Mechanized assembly equipment. Prefabricated accessories.

Mechanical equipment for the production of welded structures. Mechanical equipment for the production of welded structures. Classification of mechanical equipment of welding production. Equipment for the installation and moving of welded products. General characteristics. Installation of welded products. Manipulators, positioners, rotators, tilters, roller stands, boards and racks. Equipment for the installation and moving of welding machines and welders. Columns and trolleys for moving welding machines. Equipment for lifting and moving welders. General characteristics of the equipment for sealing of welded joints. Stands with bed of flux. Devices for sealing joints with metal pads. General characteristics of the equipment for collecting and supplying the flux to the weld zone. Types and principal design of flux devices. Melt distributing assembly devices and melt holding accessories.

Production technology of beam, frame and lattice structures. I-beam and box-beam production technology. Frame manufacturing technology. Assembly and welding of lattice structures.

Technology of production of oversized capacities and structures. Types of containers and tanks. A method of rolling of sheet structures. Assembling and welding of cylindrical tanks. The technology of manufacture and installation of spherical tanks. Production technology of tanks, working under pressure. The requirements for the production technology of containers, working under pressure.

Production of thin-walled and thick-walled containers. Industrial robots and their use in assembly and welding industry. Overview of industrial robots. Structure and classification of robots. Technical characteristics of individual units. Industrial robots and robotic systems for the main processing steps. Assembly-welding process systems.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO2 Know the theoretical knowledge and practical skills and production of reinforcement metal structures</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - Basics of welding technology and assembly of steel structures; - The main parameters of welding and cutting modes; - Safety basics for working with welding equipment; - Types of welding; - The characteristics and features of welding processes. - Energy sources for welding; - Features of the impact of shielding gas and electrode coatings on the welding arc; - The distribution of heat in solids under the influence of the thermal welding cycle; - The main criteria for assessing the weldability of industrial alloys; - The basic technology of the automated welding production; - The structure of welding rectifiers and transformers; - Current-voltage characteristics of the conventional welding rectifiers and transformers; - The nomenclature of manufactured welded structures; - Requirements for the development and manufacturing of welded structures; - Classification of mechanical equipment of welding production; - Causes of strain and stress in welding; - Production plants and machines for welding of steel structures; - Advanced technology development and implementation of the design of welded metal. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Organize the welder's workplace; - Possess the technique of welding works at carrying out electric and gas welding works, setting and adjustment of the equipment; - Evaluate the weldability of the alloy based on its chemical composition, characterized by mechanical properties of alloys; - Make calculations of basic parameters of welding conditions; - Carry out the acceptance of the materials by type; - Carry out the preparation of structural steel and reinforcement; - Know methods of marking and installation of templates, jigs; - Know methods of edge manufacturing, selection of electrodes, tack welding elements; - Carry out the assembly of metal structures; - Weld metal structures; - Apply the safety rules for the production of works.

Moulder-Concreter-Hookman

PM. 03 Production of concrete mix

Purpose:

To generate among students a system of theoretical knowledge and practical skills needed for the manufacture of concrete mix needed for the production of concrete products for monolithic housing.

Introduction to module:

This module will give students an understanding of the processes occurring during the production of concrete mix, the value of the production of high quality concrete mix and skills in achieving the quality of the concrete mix; be able to calculate and adjust the composition of the concrete mix; know the technology of factory production of concrete mixtures, to know the theory of hardening concrete mixes.

Content of module:

Concrete Science

The properties of binders

Laboratory work No 1 “Determination of normal consistency and setting of cement paste”.

Laboratory work No 2 “Determination of cement fineness by the residue on a sieve.”

The properties of inert materials

Laboratory work No 3 “Determination of rock crushability”.

Laboratory work No 4 “Determination of the content of lamellar (fleaky) and needle shape of rubble”.

Laboratory work No 5 “Determination of grain composition, fineness modulus of sand in accordance with GOST 8735”.

Laboratory work No 6 “Determination of dust and clay particles in the sand”

Types and properties of chemical additives. Additives regulating the rheological properties of concrete mixtures.

The main directions of use of plasticizers.

Set-modifying admixture of concrete mix and concrete hardening; increase strength, corrosion resistance and resistance to frost, reducing the water permeability.

Anti-freeze additives. Properties of water for tempering concrete mixtures.

Types of concrete mixtures and their properties.

Equipment for the production of concrete mixtures

Equipment for the transport of materials.

Equipment for storage facilities of raw materials

Concrete mixing plants

Automation of production processes.

Laboratory work No “Determination of the persistence properties of the concrete mix”

Factory production technology of concrete mixture

Delivery, unloading and storage of binders
 Warehouses of aggregates
 Preparation of concrete mix
 Transportation of concrete mix
 Thermal processes, physical and chemical processes in the hardening concrete.
 Calculation of concrete mixture and methods of adjustment.
 Quality control of concrete mix
Laboratory work No 8 “Determination of bulk density of expanded clay gravel”
 Safety during the works

Learning outcomes after successful comple- tion of this module, the student should:	Assessment criteria The student should
LO3 Know theoretical knowledge and practical skills of concrete mix manufacturing	<p>KNOW:</p> <ul style="list-style-type: none"> - Different types of building materials and their properties; - Features of production technology and application, the relationship of composition, structure and properties of building materials; - Theoretical foundations of Concrete Science and production of concrete with specified properties; - Types and purposes of the use of chemical additives for concrete - The basic processes of preparation of concrete mixes, formation of different concrete structures and their thermal treatment, as well as production control; - Equipment for the transport and storage of materials, equipment for dosing and mixing materials; - Rules for the transport of concrete mixtures; - Safety and environmental protection measures <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Prepare the equipment for work; - Choose the necessary materials for concrete; - Be able to determine the suitability of materials for concrete; - Define the basic properties of concrete mixtures and other materials to meet the requirements of regulatory documents; - Carry out adjustments to the concrete mixture in aggregate size, bulk density, water-cement ratio; - Work on the mixing equipment; - Be skilled in the calibration of metering devices; - Distinguish methods of work on the transport device; - Determine the concentration of additive solutions; - Produce a solution of chemical additives of a certain concentration; - Work with the storage equipment of binders and inert materials; - Apply the safety rules for the production of works.

PM. 04 Production of reinforced-concrete products

Purpose:

To generate among students a system of theoretical knowledge and practical skills needed for the manufacture of reinforced-concrete products used in construction of buildings and structures.

Introduction to module:

This module will give students an understanding of the technological processes of production of reinforced-concrete products and structures: molding processes, methods and materials for the reinforcement, the concept of prestressed structures and methods for producing prestressed products, the theory of hardening concrete mixes, methods of thermal processing of concrete products, foundations for hardening of concrete mixtures, types of forms for the manufacture of concrete products, factory-assembled products.

Content of module:

The range of reinforced-concrete products. General information about reinforced concrete. Classification of reinforced-concrete products. The range of concrete products. Reinforcing of prestressed products.

Production of chemically prestressed reinforced concrete structures. Reinforcement of products.

Types of lubricants and their impact on the quality of concrete products.

Physical and mechanical foundations for compaction of concrete mixtures. Thermal processing of reinforced-concrete products.

The theory of hardening concrete mixes. Stripping and transportation of finished products.

Classification and characterization of molds for the manufacture of reinforced-concrete products and structures.

Factory surface finishing of concrete products. Technical and economic indicators.

Safety during the works.

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
LO4 Have theoretical knowledge and practical skills in the manufacture of reinforced-concrete products.	<p>KNOW:</p> <ul style="list-style-type: none"> - The range of concrete products; - the basic technological processes of manufacturing of concrete products, forming a variety of concrete structures and their thermal treatment, as well as production control; - The standards and technical requirements for products in terms of linear dimensions, shape and appearance; - The basic properties of the concrete mix; - Rules for transportation of reinforcement; - Requirements to the appearance of products; - Operating principle of maintained equipment; start and stop rules, and lubrication of maintained equipment; - Requirements to the quality of molded products; - Purpose of used tools and devices. - Concrete products transport regulations; - Safety and environmental protection measures. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Perform ancillary work in forming concrete products and structures; - Move the reinforcement meshes, frames, inserts and mounting tabs with stacking them in die mould; - Level the concrete mix in the die mould using a hand tool; - Clean the edges of the die mould from concrete residues; - Smooth down the open surface of the molded article; - Clean the demolded articles from the breakup; - Clean the embedded parts and reinforcement of concrete issues; - Mark the products with the help of a stencil or stamp; - Cast the die mould; - Apply the safety rules for the production of works

Technician-Technologist

PM. 05 The study of the basic properties of building materials and their structures

Purpose:

To generate among students a system of theoretical knowledge and practical skills required to define the type and quality of building materials and products according to the external signs and marking.

Introduction to module:

This module will give students an understanding of the relationship of composition, structure and properties of construction and building materials, ways of formation of the given structure and properties of materials with maximum economy of resources, as well as indications of methods of assessing the quality, purpose and scope of the construction materials.

Section 1. Fundamentals of Physical Chemistry

The scientific and practical significance of physical chemistry. Aggregate states of matter. Chemical thermodynamics and thermochemistry. Chemical kinetics and catalysis. Photochemical reactions. Chemical equilibrium.

Non-electrolyte solutions. Solutions of electrolytes

Section 2. Building materials

Basic concepts of building materials. The basic properties of building materials. Classification and requirements for building materials: properties, structure and composition of building materials. Physical properties and structural characteristics of building materials. The mechanical properties of materials. Strength of materials and methods for their definitions, and other mechanical characteristics. Natural materials.

Wood and materials made of wood. The structure and composition of the wood. The most important properties of wood. Defects of wood. Timber and lumber used in construction. Protection from dry and fire.

The structure and composition of the wood.

Practical work No1 “Determining the physical and mechanical properties of wood”.

Natural stone materials. Overview of stone materials. Rock-forming minerals. The rocks used in construction. Mining, processing of stone materials. Products and materials made of natural stone. The rocks used for building structures and materials. Materials and products obtained by sintering and melting.

Ceramic materials. The raw materials. The general production scheme of ceramic products. Wall materials, their types, properties, and purpose. Ceramic materials for various purposes. Bricks and stones for special purposes. Refractory and other finishing ceramic materials. Ceramic structures for the walls. Materials and products made of mineral melts. Physical and chemical bases for production of products from glass melts. Materials and products made of them. The properties of the sheet glass, their types and purpose. Glass ceramics and slag glass-ceramic. Stone casting. Materials and metal products. General information on metals and alloys. Structure and properties of iron-carbon alloys. The technology of ferrous metals. The properties of cast iron. The properties of steels. Heat treatment of steel. Non-ferrous metals and alloys. Aluminum alloys, properties and construction purposes. Copper-based alloys. Corrosion of metals and protective measures against it.

Mineral binders. The inorganic binders. Overview of inorganic binders. Classification of binders. Air and hydraulic binders. Gypsum binders, their types, properties, and purpose. Production technology. Hydraulic binders. Hydraulic lime, raw materials, production, properties, purpose. Portland cement, its preparation, properties and purpose. The mineralogical composition of clinker. Varieties of Portland cement. Portland cement with mineral additives: pozzolan; slag cements; aluminous; expanding Portland cement. Organic binders. Properties. General information. Bitumen and tars, classification, properties, and purpose. Asphalt and tarry concrete, their preparation, properties and purpose. Materials based on organic binders. Rolled roofing materials. Waterproofing materials. Their types, properties and purpose. Polymers and materials on their basis. Thermoplastic polymers. Thermosetting polymers. Rubbers. Natural polymeric products. Materials based on binders.

Aggregates for concrete and mortars. Fine aggregate, its characteristics. Types of sand, their estimate for concrete and mortars. Schedule of grain composition of sand. Coarse aggregate, its types and quality assessment for concrete. Concretes. Classification of concretes and their requirements. Types of concrete. Materials for heavy concrete, properties of concrete and concrete mix. Light concrete, properties and purpose. Basics of concrete technology. Design of concrete composition. Calculation of components per 1 m³ of concrete mix. The calculation of the components on the capacity of the concrete mixer. The special properties of concrete. Special types of heavy concrete. Laying, curing and hardening of concrete mix. Curing of concrete, quality control. Features of concreting in winter.

Mortars. Classification of mortars. Their types and purpose. Properties of mortars and hardened mortars. Mortars for masonry and plaster. Artificially-stone materials. General information. Lime brick, its preparation, properties and purpose. Gypsum and gypsum concrete products, types, properties, and purpose. Gypsum and gypsum concrete products, types, properties, and purpose.

Special Materials.

Thermal insulation and acoustic materials. General information and classification of insulating materials. Structure and properties of thermal insulation materials.

Acoustic materials. Acoustic materials and products. Sound-absorbing materials, their types, properties and purpose. Sound-proof materials and products, their types, properties, and purpose.

Paints and varnishes. General information on paints and varnishes. Pigments and fillers. Their types, properties and purpose. Binders. Their types, properties and use in colored formulations.

Paints and auxiliary materials. Colorful compositions: water, emulsion, oil, enamel; putties, primers, putty; wallpaper types, properties and purpose. Concrete products. Plastics and polymers.

Laboratory practicum.

Laboratory work No 1 “Determination of normal consistency and setting of cement paste”.

Laboratory work No 2 “Determination of the compressive strength and bending strength of cement samples”.

Laboratory work No 3 “Determination of cement fineness by the residue on a sieve”.

Laboratory work No 4 “Determination of rock crushability”.

Laboratory work No 5 “Determination of the content of lamellar (fleaky) and needle shape of rubble”.

Laboratory work No 6 “Determination of grain composition, fineness modulus of sand in accordance with GOST 8735”.

Laboratory work No 7 “Determination of dust and clay particles in the sand”

Laboratory work No 8 “Determination of the conservation properties of the concrete mix”

Laboratory work No 9 “Determination of concrete mix mobility”

Laboratory work No 10 “Determination of moisture content of wood”

Laboratory work No 11 “Determination of the brand of expanded clay gravel”

Learning outcomes after successful completion of this module, the student should:	Assessment criteria The student should
<p>LO5 Have the theoretical knowledge and practical skills required to define the type and quality of building materials and products by the external signs and the marking.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - The relationship of composition, structure and properties of construction and building materials; - Ways of formation of the given structure and properties of materials at the maximum resource and energy efficiency; - Methods for studying the properties of construction materials, as well as methods for assessing their quality indicators. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - Choose the appropriate construction materials that ensure the required reliability performance, safety, economy and efficiency of facilities under specified conditions; - Analyze the impact of the environment on the material in the design, establish requirements for the building and construction materials in the specified operating conditions - Use the methods and means of controlling the physical and mechanical properties of materials in constructions

PM. 06 Organization of the production process of reinforced-concrete and metal products and structures

Purpose:

To generate among students a system of theoretical and practical knowledge in the field of technology and organization of production of concrete and metal products able to effectively address the practical problems of production of concrete and metal products, as well as to contribute to the further development of the individual.

Tasks:

To make technological tests, technical maintenance, storage and repair. Know technology and methods of organizing the production of reinforced-concrete and metal products.

Introduction to module:

The module. PM 06 “Production process of reinforced concrete and metal products”, is a professional level, and is presented in the structure of the basic professional educational program on a specialty 1413000 “Production of reinforced-concrete and metal products (by type)” in the cycle “Professional modules” for Technician-Technologist. This module gives students an understanding of the technology and organization of production of reinforced-concrete and metal products; the formation of the skills of independent, creative application of theoretical knowledge, the ability to use the regulatory and reference works in practice; mastery of skills development and assessment of technological and organizational processes of manufacture of precast reinforced-concrete structures and the implementation of techni-

cal and economic calculations in the selection of basic technological processes and the rational organization of manufacture of precast reinforced-concrete and metal structures. Development of the module is a necessary foundation for further study of general and professional basic modules:

BGPM .01 Transportation of various cargo

BGPM. 02 Carrying out laboratory tests for the quality control of materials and products

BGPM. 03 Quality control of reinforcement and metal products and structures

BGPM. 04 Quality control of reinforced-concrete products and structures

PM. 01 Production of reinforcement products

PM. 02 Production of reinforcement and metal structures

Content of module:

Section 1.

Fundamentals of Descriptive Geometry

Projection method, projection types

System approach as a basis for engineering. Basic concepts of descriptive geometry: a plane coordinate system, spatial coordinate system, geometric element, the projection

Practical work No 1 Projection method, projection types

The point in the two and three projections planes. Diagrams Monge.

Practical work No 2 Building the point on its coordinates in eight octants. Constructing points' projections. Solving problems

Lines and planes in the two and three projection planes

The projections of a straight line at different positions relative to its projection planes. The relative position of the point and straight. Methods of specifying the plane. The level lines. Projecting the right angle

Practical work No 3 Lines and planes in the two and three projection planes

Practical work No 4 Building a trace of line, determination of its true length. The division of the segment in this regard. Building a direct traces. Drawing the plane, transformation of the plane defined by three points in the plane, set by traces. Building level lines of the plane. Solving problems

Building the line and the plane, the intersection of two planes. Algorithms for constructing the intersection point of the straight line and the plane, the line of intersection of two planes

Practical work No 5 The intersection of the line and the plane, the intersection of two planes

Practical work No 6 Constructing the point of intersection of line and plane, perpendicular to the plane. The intersection of two planes. Determination of points of view. Solving problems

Methods of projection transformation, The method of changes of the plane projections and the main problems to be solved it. Rotation method. The rotation around axes perpendicular and parallel to the projection planes. Rotation around the level lines. Alignment method. The main types of metric tasks to be solved by means of projection transformation.

Practical work No 7 Determining the actual size of geometric objects, distances

and angles

The lines and surfaces. Classification dimensions curves and surfaces. Screw and cyclic surface. Tangent lines and planes to the surface of rotation. The intersection of the surface of the plane and right line.

Practical work No8 Curve lines and surfaces

Practical work No 9 Construction of the lines of intersection of the plane with surfaces of revolution, piercing point of a line with a surface. The methods of constructing the trace of surfaces. Solving problems

Involute of surface. Methods for constructing involute of surface. Involute of multi-faceted and curved surfaces.

Practical work No 10 Involute of surface

Practical work No 11 Constructing involute of faced and ruled surfaces. Solving problems

Pictorial projection

Properties of pictorial projections. Rectangular and oblique and isometric and dimetric projections, rules of their construction

Practical work No 12 Pictorial projections

Practical work No 13 Building a pictorial view of the faced and linear figures.

Section 2. Fundamentals of Thermal Engineering

Basic concepts. Design and operation of steam generators, reactors, nuclear power plants and the issue of the economy. The working fluid, state parameters, the equation of condition of the working fluid.

The first law of thermodynamics.

The amount of heat, change in the internal energy, the external work, enthalpy. The first law of thermodynamics as a special case of the general law of conservation and transformation of energy. Equilibrium and non-equilibrium processes. Reversible and irreversible processes. Circular processes or cycles. The concept of the ideal and real gas.

Basic thermodynamic with an ideal gas. The equation of state Clapeyron - Mendeleev for an ideal gas and the gas mixture. Gas constant.

Isochoric, isobaric, isothermal, adiabatic and polytropic processes with ideal gas, general properties of the internal energy of an ideal gas. Thermal capacities processes.

The second law of thermodynamics.

Carnot direct reversible cycle and its coefficient of efficiency. An arbitrary reversible cycle. Clausius Integral. Entropy. Thermal diagram (TS -diagram). Image of thermodynamic processes in TS - diagram. Carnot cycle in TS - diagram. Carnot Cycle with regeneration.

The spontaneous increase in entropy in irreversible and adiabatic processes. Entropy and probability theory.

Entropy method for estimating the health system and its use.

Exergic method of assessing the health system and its use. Entropy and the "theory of heat death" of the universe. The application of the first and second laws of thermodynamics to work of heat engines with an ideal gas. The indicator diagram and the ideal cycle at the ICE in various conditions of heat supply. Driving and gas turbine cycle with isobaric heat supply. The use of regenerative heating of the working fluid in the gas turbine. Intermediate cooling and intermediate heating of the working

fluid in the gas turbine. Methods to improve the efficiency of heat engines cycles. Real gases. The process of vaporization in the PV - and TS -diagram. Basic concepts of the thermodynamic characteristics of water steam (enthalpy, internal energy, degree of dryness, the heat capacity of steam). Tables of thermodynamic properties of dry saturated and superheated steam and boiling liquid HS -diagram of steam. Isobaric and adiabatic processes with steam. Throttling of steam.

The cycles of steam turbine units (STU). Rankine scheme and cycle of steam turbine. Influence of initial and final parameters of steam on the efficiency of the turbine plant. The cycle of the steam turbine plant with a secondary steam superheating. STU with regenerative feedwater heating. Heating cycle of steam turbine units. Gassteam cycle. Cycles of nuclear power plants.

Units for the direct conversion of heat into the operation. The operating principle of magneto-hydrodynamic generator. Magneto-hydrodynamic installation of open and closed circuits. Thermoelectric generators.

The thermodynamics of the stream. The first law of thermodynamics to flow, the enthalpy of braking. The exhaust velocity in the differential enthalpy function. The exhaust velocity as a function of the pressure ratio. Laval nozzle.

Stationary and transient heat transfer.

The output of the differential equation of heat conduction. The boundary conditions in heat transfer problems and the way of setting them. The thermal conductivity in the planar and the cylindrical wall of the single and multilayer. Heat transfer coefficient. Transient thermal conductivity.

Convective heat and mass transfer. The mechanism of convective heat transfer and mass. Differential equations of convective heat transfer. The energy equation. The equations of a viscous liquid movement. The equation of continuity of flow. Application of similarity theory for generalization of experimental data. Thermal similarity criteria, their physical nature and forms of communication between them. Heat transfer in free convection. Heat dissipation with forced convection in the conditions of internal and external problems. Heat transfer when changing the state of aggregation.

Radiation heat transfer. The basic laws of radiant heat transfer. Particular cases of radiation heat transfer. The role of the screens at the radiation protection. The calculation of radiative heat transfer in combustion chambers.

Heat exchangers. The regenerative and regenerative heat exchangers. The main circuit switching and heat transfer equation for calculating the thermal recuperative heat exchangers. Thermal and hydrodynamic calculation of heat exchangers. Exergy analysis of heat exchangers.

Section 3. Equipment, processes and production technology. Production of precast reinforced-concrete and metal structures.

The equipment used for reinforcement work. Technical and economic indicators of reinforcement shops. Technology of the reinforced concrete structures formation. Composition of technological process operations of formation the reinforced concrete structures, their interrelation and sequence of performance. Types and constructions of forms. Turn-over of forms and capacity of production, decrease ways of capacity. Cleaning and lubrication of forms, used equipment. Types of used lubricants and requirements for them. Transportation of concrete mixes and their laying in forms. Transportation equipment. Concrete distributors and concrete placers, devices for laying on forming posts.

The main types of enterprises for the production of precast reinforced concrete: house building factories (HBF), large-panel house building plant (LHBP), bulk-block housing plants (BBHP), concrete products plant (CPP), rural buildingGeneral provisions of production technology of precast reinforced-concrete structures. General concepts of reinforced concrete, precast concrete complexes (RBC). Indicators of products manufactured by enterprises of precast constructsures. Nomenclature and classification of concrete structures. The role of precastcrete - JSC, PLC, LLC and other organizations of construction industry. The main divisions that make up plants and landfills warehouses for fillers and binders, con-crete mixing plant, reinforcing shop, molding and curing shop, the finished product warehouse, auxiliary shops.

The concept of industrial and technological processes and technological operations. Basic technological processes in the manufacture of precast concrete structures. The concept of the conveyor, thread-aggregate and bench production methods of industrial structures.

Basic regulations on manufacture of precast concrete production technology: state standards, building codes, engineering standards, guidance, advice and guidance on reinforced concrete structures. The structure and purpose of regulations.

Mechanized storage for binders, fillers and reinforcing steel. Technological processes in warehouses. Calculation of the plant's annual demand for cement, inert materials and reinforcement.

The main types of cement warehouses, and their design features. Traffic flows on the cement stocks. Methods of cement unloading, equipment used. Storage of cements in silos, technological processes during unloading and storage of cement. The calculation of the technical characteristics of cement warehouse. Warehouses of aggregates (inert materials). Classification of warehouses of aggregates by the method of storage, type of container, the method of loading and unloading, the territorial orientation, referring to external transport. The calculation of the technical characteristics of aggregates warehouses. Acceptance and unloading of aggregates. Features of frontal and spot unloading. Interwarehouse transport and equipment used in warehouses of aggregates. Storage of aggregates. Preparing the aggregates undertaken in warehouses. Supply of aggregates in the concrete mixing plant. The main types of reinforcing steel warehouses. Interwarehouse transport and equipment.

Technology of preparation of concrete mixes. The structure and content of the process of preparation of concrete mixes. The main methods of mixing the components, getting the finished concrete mixture. Calculation of the technical characteristics of a concrete mixing unit. Main mixing equipment and its operation principle. Mixers with a free fall of the material, compulsory mixing plants. The principles of their operation, advantages and disadvantages. Mode for mixing concrete mixes and its purpose. New methods for mixing concrete mixtures. The volume, weight and body-weight dosing. The principles of work and design solutions of dispensers. The control system of weigher. Scheme of the vertical arrangement of the equip-ment in concrete mixing plants. Advantages and disadvantages of the tower and parterre schemes. Schemes of arrangement of mixing machines. Features of linear and breeding schemes. The main quality control of preparation of concrete mixes. Functional control of the process. Technical and economic parameters of typical concrete-mixing plants.

structions tension. Methods of tension reinforcement and creation of the

reinforce. Technology of preparation of reinforcement products and reinforcement of concrete structures. The main types of reinforcing steel used to reinforce the concrete construction. Technology of production of reinforcement elements: storage of reinforcing steel and embedded parts, the production of reinforcing mesh and frameworks. Corrosion protection of embedded parts. Process of tension of reinforced concrete structures. Fixing reinforcement in the design position. Methods of comment frame. Ways to fix the reinforcement by pulling. The technology of mechanical, electrothermal, electrothermomechanical and chemical methods for tension of reinforcement. Reinforcement tension release.

Physical nature of the densification process by vibration mixes.

Parameters and modes of vibration. Densification of concrete mix with volumetric vibrating on vibroplatforms. Densification mixes in products with inner vibrating using vibrators and vibroinserts. Superficial vibrating. Densification of mixes by method of pressing, vibropressing, rolling, vibrorolling. Centrifugation. Formation of constructions by method of casting and extrusion.

Hardening of the formed products. Thermal treatment of reinforced concrete constructions. Hardening concrete at normal temperatures. Ways of acceleration of concrete hardening. Transfer, demoulding, released and design strength of the concrete. Hardening of concrete at high temperatures. Features of formation the concrete structure by steaming. Ways to reduce the impact of destructive processes in concrete in steaming. Mode of thermal treatment. Choice of the optimum mode of steaming.

Installations for thermal treatment of reinforced concrete: pit cameras, holders, thermoforms, autoclaves, tunnel, slit-type and vertical cameras. Technical and economic indices of the thermal treatment process. Energy consumption and possible ways of their lowering.

General provisions on production organization and sales of products. Structure of material and technical base of building industry enterprises. Conditions and factors contributing to the development of construction industry in market conditions. Features of the production organization to ensure an effective economy of construction industry enterprises. Interconditionality of organization and management processes to ensure functioning and development of building industry enterprises.

Bases of the organization theory. Advanced domestic and foreign experience in the field of the production organization and management precast reinforced concrete structures for housing and industrial construction. Classification of affecting factors on the level of organization and competitiveness of the building industry enterprises.

Bases of efficient organization of the production process. Structure, principles and forms of the organization of production processes. Production types: single, serial, mass. Duration of technological cycle and manufacture batch of products. Line production organization of building constructions and products. Key performance indicators of the technological line work. Coordination the rate and tact of process-ing line. Flow capacity. Coordination handling capacity of a technological line with handling capacity of its leading repartitions. Interrelation between production indicators, release and sales of products.

Organization and planning of molding production. Selection of main and transport equipment. Structure of the technological process of producing reinforced concrete structures. Technological schemes of the main processes. Configuration of the equipment. Choice of the most progressive technological methods, cars and mechanisms. Drawing up a flow chart of production reinforced concrete structures. Structure and content of the flow chart. Works cyclogram on production of constructions. Functional control of the basic technological processes.

Calculation of technical and economic indicators of a processing line. Calculation of needs for material and energy resources. Drawing up planned calculation of unit cost.

Organization of industrial relations in the enterprise. Organization of ensuring processes for safe activity in the enterprise. Interrelation processes of reliability, organization, safety and quality. Organization of industrial relations for ensuring rhythm of equipment loading and objective assessment of a contribution of departments and services to resulting effects of production taking into account complete factory labor input of products.

Methods for determining the calculation of internal production costs. Calculation excluding shop-to-shop routing and taking into account shop-to-shop routing. Foreign experience in cost structuring and determination of profit for the responsibility centers.

Management organization of reproduction processes of fixed assets. Problems of an effective management organization of reproduction process the basic means and ways to solve them. Organizing the process of renovation and effective use of fixed assets. Methods for analyzing effective use of fixed assets. Methods for analyzing effective use of fixed assets. Organizing the process of reproduction management of fixed assets. Rationale for the preferred method charging depreciation. Rationale for decisions on the organization of fixed assets revaluation process. Comparative analysis and selection of preferred amortization policy for the enterprise.

Organization of logistics in the enterprise

Problems of efficient organization of logistics in building industry enterprises. Methods of rationing circulating assets. Organization of planning logistics in the activity of JSC HBF in current economic conditions.

Organization of contractual relationships with suppliers. Organization of works on the compilation of delivery schedules and delivery charges. Organization of management on process of development the new products. Methods for assessing the profitability of the products that proposed to release. Methods for determining projected production volume, selling prices, the cost of equipment and tooling. Determination the production payback. Conditions achieve profitability border. Determination the payback of products. Choosing manufacturing technology of products, adapted to market conditions.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
LO 6 Own technology and methods of organizing the production of reinforced concrete and metal products.	KNOW: - physico-chemical and physical properties of the cement, steel, reinforced concrete and metal constructions; - ways of obtaining products of full factory readiness; - modes of transportation and storage of the feedstock materials BE ABLE TO: - make technological calculations for different production modes of reinforced concrete and metal products and constructions; - carry out work to ensure the quality control of finished products and constructions; - improve rational and economically viable solutions in manufacture of reinforced concrete and metal products; - handle laboratory equipment; - independently determine the quality of finished reinforced concrete and metal products

PM.07 Organization, planning and management of enterprises of the building products and constructions

Purpose:

To generate in students a system of theoretical knowledge and practical skills necessary for the organization, planning and management by enterprises of building products and constructions.

Introduction to the module:

This module will give students insight to the processes of organization, planning and management of building products and construction enterprises, the ability to solve specific management tasks, independently use the theoretical knowledge in the process of self-study, determine the most effective use of all the logistical and labor resources in production.

Module content:

Section 1.Organization of production

Economy of sector. Main provisions of the economic efficiency theory in material production.

Resources of sector. Fundamentals of planning capital investments. Pricing, cost, profit, profitability, financing, accounting, reporting and business analysis.

Management in construction. Organization of production. Fundamentals of organization the production. Features of organization in the reconstruction and technical re-equipment of enterprises. Organization of product quality management.

Section 2.Enterprise management.

Enterprise management. Bases of management. Management of labor collectives. System of the principles and methods of management. Technology of management.

Organization and psychology of the head's work.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
LO7 Own theoretical and applied fundamentals of organization, planning and management in enterprises of building products and constructions.	KNOW: - know domestic and foreign experience in the field of organization, planning and management in enterprises of building products and constructions. BE ABLE TO: - solve specific management problems; - independently use theoretical knowledge in the process of individual work; - work with the special normative literature; - determine the most effective use of all material-technical and labor resources in production.

PM.08 Automation of production processes of reinforced concrete and metal products and constructions

Purpose:

Acquisition by students the knowledge in the field of theoretical bases of development and functioning of control systems, automatic and automated management of technological processes in production of reinforced concrete and metal products, and also the social and economic and ecological importance of automation in the construction industry.

Introduction to the module:

This module will give to the students an understanding of automation process in production of reinforced concrete and metal products and constructions, opportunities to solve specific automation tasks, independently use the theoretical knowledge in the process of individual work, determine the most effective way to use all material-technical and labor resources in the production automation.

Module content:

Classification of automatic systems. Systems of automatic control and alarm. Systems of remote control and telecontrol.

Systems of automatic control, management and protection.

Elements of automation systems.

Sensors of technological parameters. Sensor settings. Resistive sensors. Inductive sensors. Transformer sensors. Capacitive sensors. Piezoelectric sensors. Induction sensors. Frequency sensors. Digital sensors.

Relay.

Neutral DC electromagnetic relays. Polarized electromagnetic relay. Electromagnetic AC relay. Reed relay. Bi-metal thermal relay. Designation relay in schemes.

Main relay-contact schemes. Time relay.

Amplifiers. Electrical amplifiers. Hydraulic amplifiers. Pneumatic amplifiers.

Actuating mechanisms.

Regulatory bodies.

Construction automation schemes.

Structural scheme. Functional automation scheme. Schematic electrical circuit.

Automatic control of technological parameters.

Temperature measurement. Measurement of pressure and discharge. consumption measurement. Level measurement. Measure the parameters of substance.

Basic principles of automatic regulation and control.

Types of automatic control systems. Properties of regulation objects. regulatory laws. Programmable logic controllers. Automated control systems of technological processes.

Automation of production processes of building products and constructions.

Schemes of control of electric motors. Automation of a warehouse of concrete fillers. Management of flow-transport system. Automation of processes of dispensing and weighing. Automation of mixing processes. Automation the heating of reinforcing cores. Automation of consolidation process of concrete mix. Automation of processes of heat moist handling of reinforced concrete products.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
LO8 Own the skills of using technological schemes as a basis for the development of automation schemes of relevant production processes.	KNOW: <ul style="list-style-type: none">- theoretical foundations of automation;- the basic concepts in the field of automatic control and management in production of reinforced concrete and steel products ;- the essence of automatic and automated control systems of technological processes; BE ABLE TO: <ul style="list-style-type: none">- formulate tasks for automation of control and control of separate machines, devices and processing lines on the basis of the existing normative and technical documentation;- develop structural and functional schemes of automatic control and management of technological processes;- define the roles of automated lines at the building industry plants in improving the quality, performance, stability in manufacturing products;- emphasize the feasibility and socio-economic efficiency of automating production processes in the building industry.

PM.09 Organization of standardization, certification and accreditation at the plants of reinforced concrete and metal products

Purpose:

This module will give students understanding the fact that the method of standardization in building materials and technology takes into account the features of

work with materials and includes as components standardization of loads on the material and construction dimensions of building products, etc. This module will prepare the specialist able to effectively solve practical problems, more fully understand and apply the principles of metrology, analyze the obtained results, as well as contributing to the further development of the individual.

Introduction to the module: The student shall understand that regulating documents on products or requirements to production can change with development of technological processes, change of requirements and these processes will be reflected in regulating documents, projects, etc.

Module content:

Standardization tasks. Basic concepts, terms, determinations. Regulating documents on standardization and types of standards. Elements of the international and regional standardization. Main requirements of the Law RK "About Technical Regulation".

Standardization levels. International and regional standardization. International cooperation in the field of standardization.

Fundamentals of measurement theory. Qualitative and quantitative characteristics of the measured values. The International System of Units (SI). Errors of measurements, methods of detecting errors.

Structure and composition of the State standardization system of the RK Standard. Types of standards. Fundamental standards. Qualifiers standards.

Safety, quality products and services. Quality indicators of products.

Classification of indicators of quality of production and services.

The structure and composition of the international standards of ISO family. Standards ISO 9000, ISO 9001, ISO 9004.

National standards for the quality management systems. Basic requirements and recommendations for manufacturing quality assurance of products (GOST R ISO 9001, GOST R ISO 9004).

State standards for quality system

Classification of technical control and product testing operations. Fundamentals of technical control systems in the organization. Statistical Quality Control.

The general procedure and rules for the certification of production and quality systems.

The role and importance of the legislative framework of certification in the Russian Federation. Mandatory and voluntary certification.

The procedure and rules for accreditation of certification bodies and testing laboratories in the certification system. Selection and appointment of products certification scheme. The main elements of products certification scheme. Certification of production in the quality system. Requirements for any organization certifying production or quality system. The procedure and methods of production preparation for certification.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
<p>LO9 Own standardization technique in building materials and manufacturing technology of reinforced concrete and metal products.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> -standardization problems, its cost-effectiveness; -basic provisions of systems (of complexes) general technical and organizational methodological standards; -basic concepts and definitions of standardization, certification and documentation of quality systems; -terminology and unit of measurement values in accordance with the applicable regulations and international SU system of units; - forms of quality confirmation; - documentation of quality systems; - unity of terminology, measurement units with the applicable regulations and international system of units in educational disciplines; - the main provisions of systems (of complexes) general technical and organizational methodological standards; - bases of improvement product quality; - knows the main technological processes that require technical and laboratory control; - the requirements of laws, technical regulations, GOST ISO / IEC 17025 and other ND; - the types and tests of quality control. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - use in professional work documentation of quality systems; - draw up technological and technical documentation in accordance with the current regulatory framework, based on the use of the main provisions of certification and standardization in production activities; - bring non-systemic measurement values in accordance with the applicable regulations and international system of units SU; - apply the quality system documentation; - apply regulatory requirements to basic products (services) and processes; - carry out testing and control of products; - statistical acceptance control

Junior production engineer

PM.10 Performing calculations and construction of reinforced concrete structures

Purpose:

This module contributes to train junior production engineers, to study the basics

of designing, manufacturing, installing and strengthening of reinforced concrete structures of buildings.

Introduction to the module:

Reinforced concrete structures are the basic building constructions with an extensive field of application, so technical training of specialists should include an in-depth study of the foundations of theory of theoretical mechanics and concrete resistance, as well as the design of reinforced concrete structures of buildings.

Module content:

Section 1. Fundamentals of theoretical mechanics

Statics. Basic definitions and axioms of statics. Two problems of statics. Links and their reactions. The postulate of releasability from links. Moment of a force relative to a point. Force moment relative to the axis. Couple of forces and its scalar and vector moments. The main vector and the main point of an arbitrary system of forces. Theorem on the steadiness of arbitrary system of forces. Conditions of steadiness of different types of private force systems. Three forms of steadiness conditions for a flat system of forces. Equilibrium of a one rigid body and balance system absolutely rigid bodies. External and internal forces. Statically determinate and statically indeterminate system. The degree of static indeterminacy. Theorems on the pairs of forces and operations with them. Bringing the system of converging force to equal operating. Bringing arbitrary system of forces to the center. The theorem on the equivalence of the two force systems. A special case - the flat system of forces. Conditions of bringing arbitrary system of forces to equal operating. The relationship between the principal moments of force systems to two different bringing centers. Invariants of an arbitrary system of forces. Varignon Theorem. Bringing of an arbitrary system of forces to the dynamic screw. Central screw axis. System of parallel forces and their reducing to simple equivalent system. The center of the system of parallel forces. Distributed system of parallel forces. Simplest particular case to bring them to equal acting. Link-type flat and spatial terminations. Friction. Types of friction. Experimental laws for different kinds of friction. Methods of equilibrium solutions of the problems with friction. The body's center of gravity. Theorems on the centers of gravity of the bodies that have symmetry. The centers of gravity of some simplest geometrical bodies. Methods of finding the centers of gravity. Statics ideal inextensible thread. Equations of equilibrium of free thread element in vector form and projections on the coordinate axes. Equilibrium thread on a smooth surface. Equilibrium thread on the nonsmooth cylindrical surface. Euler's formula.

Kinematics. Counting systems. Methods of specifying the motion of point. Speed and acceleration of point at various ways of setting its motion. Speed and acceleration of point in curvilinear coordinate systems. Kinematics of rigid body. Theorem on projections of speed vectors on two points of rigid body. The simplest movements of rigid body. Forward motion. Rotation of rigid body around a motionless axis. The equation of motion, angular speed and angular acceleration of the body. Speed and acceleration of points of the body with its rotational motion. Plane-parallel motion of a rigid body. Decomposition it on forward and rotary movement. The kinematic equation of plane motion. Vector formula for speeds points of the body

with the plane motion. Instantaneous speed center, the methods of its location plane motion. Instant acceleration center. Spherical motion of a rigid body. Euler angles. Rodrigues-Hamilton parameters. The kinematic equations of motion. Application of matrix methods. An instantaneous axis of rotation. The instantaneous angular speed and the instantaneous angular acceleration. Speed and acceleration of points of the body during its spherical motion. Formula Euler and Rivalsa. The general case of a free rigid body motion. Decomposition of it to forward and spherical motion. The instantaneous axis of rotation. The instantaneous angular speed and angular acceleration. The speed and acceleration of the point a free rigid body (vector formula). The complex motion of a point. Absolute, portable and relative motion. Theorems on the speed and acceleration of the point at the complex movement. Coriolis acceleration. The complex motion of a point at a known trajectory of absolute motion. The complex motion of a rigid body. Addition of rotations around two intersecting axes. Addition of rotations around two parallel axes. Addition of forward and rotary movements (screw movement). Addition of any number of rotations around the crossed axes. Addition of any number of rotations around parallel axes. Addition of any number of forward and rotary motions.

Dynamics. Dynamics of a material point. Inertial reference systems. Differential equations of motion for a free and non-free point in the vector and coordinate forms. The equations of the point motion in the projections on the axes of the natural trihedron. The first and second tasks of dynamics. Dynamic reaction links for non-free point. The use of differential equations of the point motion to solve problems of the first and second dynamics. Integrable equations of rectilinear the point motion (an equation with separable variables, linear equations with constant coefficients). The dynamics of the relative the point motion. Not inertial reference systems. The equations of the relative motion. Portable and Coriolis forces of inertia. Galileo's principle of relativity. Differential equations of motion of a point in polar and cylindrical coordinate systems. The concept of the mechanical system. The external and internal forces. Properties of the internal forces. Differential equations of motion for a free and non-free mechanical system in the inertial reference system. The center of mass of the mechanical system. Theorem on the motion of the mass center. Special cases (keeping the center of mass on the projection speed or coordinates). Differential equations of forward motion of rigid body. The geometry of the masses. The moments of inertia of the system relative to the point, the axis and a plane. The centrifugal moments of inertia. The moment of inertia relative to the axis of predetermined direction. Inertia tensor. Inertia ellipsoid. Main axes of inertia, main central axes of inertia. Main theorems of the main axes of inertia. Main central moments of inertia. Steiner's theorem and its analog for the centrifugal moments of inertia. Calculation of the centrifugal moments of inertia. Inertia radius. Formulas for a inertia tensor of some elementary bodies. Inertia radius. Steiner's theorem for the bodies having an axis of material symmetry.

Quantity of motion of the material point and the mechanical system. Elementary and total momentum force. Theorem on the change of the amount of motion of the system in differential and integral form. The particular case - the preservation of the quantity of the motion. Movement point of variable composition. Reactive force. Mesherskiy equation. Tsiolkovsky formula. Vertical movement of the rocket. Kinetic moment of points and the mechanical system relative to the center and relative to the axis. Theorem on change kinetic momentum in differential and integral form.

Particular cases - the preservation kinetic momentum relative to the center and relative to the axis. point movement under the influence of a central force. Sectoral speed. squares theorem. Formula Binet. Kinetic momentum of a rigid body relatively to the axis. The differential equation of the rotational motion of a rigid body around a fixed axis and the cases of its integrability.

Kinetic momentum of the mechanical system during its complex movement. Theorem on change kinetic momentum of the system in relatively motion in relation to the center of mass. Differential equations of a plane motion of rigid body. Elementary and the total work force. Power. Work of internal forces of system. Calculation of work of forces applied to a solid body at different types of its movement. Kinetic energy of a material point and mechanical system Calculation of kinetic energy of system at its difficult movement. Kinetic energy of a solid body at different types of its movement. Theorem of change of kinetic energy of system in differential and integrated forms. Potential force field. Elementary and full work of force in potential force field. Power function and the potential energy of the field. Examples of calculation of the potential energy: a uniform gravitational field, the field of linear elastic force, field of attraction according to Newton's law. The law of conservation the total mechanical energy. Conservative systems. Analytical representation of links and their classification by this feature. Possible movement. The elementary the work of force on a possible displacement. Ideal links. Holonomic and nonholonomic constraints. The principle possible displacements. The number of degrees of freedom of holonomic system. Generalized coordinates. Generalized forces. Methods for calculating the generalized forces. Generalized forces, arising from the potential forces. The principle of possible displacements in the generalized coordinates. The equilibrium conditions of conservative systems. The inertia forces of the material point. Conditions of equilibrium of conservative systems. The forces of inertia of the material point. D'Alembert's principle for point and system of material points. The main vector and principal moment of inertia forces in general and particular cases of rigid body motion. The general equation of dynamics. The use of D'Alembert's principle to determine the reactions in the solid body footing, rotating around a fixed axis. Static and dynamic components of the reactions. Particular cases. The concept of static and dynamic equilibration of rotating body. Lagrange equation of the second kind: the withdrawal and methodology of the application. The structure of the kinetic energy of the mechanical system. Structure of Lagrange equations of the second kind. The structure of the generalized forces: position forces (potential and non-conservative), dissipation and accelerating forces, gyroscopic forces.

The canonical equations of mechanics. Notions of equilibrium state and the equilibrium position of the mechanical system. Finding the equilibrium positions of equilibrium conditions expressed in the generalized forces. Examples. Stability of equilibrium of the system. Criterion of Lagrange stability of the equilibrium of conservative systems. Resistance forces proportional to the first degree speed of system points. Rayleigh dissipative function. The relationship between total mechanical energy of the system and a dissipative function. The impact on the stability equilibrium systems of dissipative, accelerate and gyroscopic forces. The concept of small moves system around a stable equilibrium state. Approximate expressions of the kinetic and potential energy for a conservative system with one degree of freedom. The differential equation of free motion of a conservative system with one degree

of freedom in the case of small deviations from the equilibrium state.

Harmonic oscillations. Examples. Small free motion system with one degree of freedom in the presence of the linearly viscous resistance. Damped oscillatory motion. The decrement, the logarithmic decrement. A periodic motion. Forced oscillations of a system with one degree of freedom. Methods excitation of forced oscillations. Impact of resistance to forced oscillations. Interaction of natural and forced oscillations. Resonance in the absence and presence of the linearly viscous resistance. The amplitude-frequency and phase-frequency characteristics of the system. The kinetic and potential energy of a conservative system with two degrees of freedom. Conditions of stability of equilibrium of a conservative system with two degrees of freedom. The equations of small free oscillations. Frequency equation. The partial frequency. Properties of the natural frequencies of the system. The main forms of oscillations. The main coordinates. Forced oscillations of a system with two degrees of freedom. Motion of rigid body around a fixed point. Kinetic momentum of a rigid body relatively a fixed point, its projections on the coordinate axes. Kinematic and dynamic Euler equations. Review of integral cases equations of motion of a heavy body with one fixed point (Euler cases, of Lagrange, Kovalevski). The geometric interpretation of Euler-Poinsot case. The notion of a regular precession. An approximate theory of a gyroscope. Theorem of the Resal. Gyroscopes with three and two degrees of freedom. The gyroscopic moment. Precession of heavy gyroscope. Examples of applications in the technique gyroscopes. Variational principles of mechanics (the principles of Gauss, of Lagrange, Hamilton). Nonholonomic system. Examples of use in the technique. Energy acceleration. Gauss principle for nonholonomic systems. Appell equations. Main provisions of the approximate impact theory. The change of angular speed at impact by rotating body. The point of impact on the stable surface. Recovery coefficient. Impact phase. Impact impulses for two phases of impact. Carnot's theorem. Direct central impact of two bodies. Particular cases. Impact on a rotating rigid body. Conditions for the absence of impact reactions in the of rotating body footing. The center of impact. The general equation of dynamics and Lagrange equations of the second kind on impact.

Section 2. Fundamentals the materials resistance

Key Definitions. The real object - the calculation scheme. Classification bodies in geometrical parameters. Classification of external forces. Hypotheses about the properties of the material. The supporting device. Internal forces. Tension, normal and tangent tension, concept about tension of a point. Method of sections. Internal power factors in the cross section of a core and the types of deformations corresponding to them. Principle of stability of the initial sizes. Principle of independence of action of forces. Saint-Venant's principle.

The central tension-compression straight bar. The internal force factors in the rod during the central tension - compression. Normal force, differential independence of it from the external load, the normal tensions in cross-sections. The hypothesis of plane sections. Longitudinal and transverse deformation, Poisson's ratio. Hooke's law under uniaxial tension-compression. Move the cross-sections of the rod and its lengthening. The potential energy of deformation. Technique of construction diagrams in the rod during force loading, the use of differential dependencies. Statically Definable and statically indeterminable tasks in tension - com-

pression. Temperature strains and stresses. Mounting tension. Stiffness and compliance, the application of de-composition to the analysis of statically indeterminate rod systems in tension-compression. Tensions in the inclined sections of the rod in tension-compression. Experimental determination of mechanical properties of materials under the central tension-compression. Conditional and true chart. The mechanical characteristics of the material. Plastic and fragile materials. The law of unloading and reloading. Effect of temperature on mechanical properties. The notion of creeping, aftereffect, relaxation, long-term strength. Strength analysis on the allowable tensions. Regulatory strength coefficient, strength condition. Designing calculation, definition cross-sectional area. Determination of the permissible load. Checking calculation, the actual safety factor. Calculation of stiffness. Conditions of stiffness. Shift. shift phenomenon. Pure shear. An analysis of the state of tension in pure shear. The relationship between elastic modules of the first and second kind, and Poisson's ratio. The potential energy of deformation under shift. Calculation of structural elements on cut.

The geometrical characteristics of the cross-sections of rods

Key Definitions. General properties of geometric characteristics. Static moments of a plane figure, the central axis, the center of gravity. Changing the moments of inertia in parallel transfer and rotation of the coordinate axes. The main axes and principal moments of inertia. The moments of inertia of simple figures. The algorithm for determining the principal central axes and calculate the moments of inertia for non-thin-walled sections. Features of calculation the geometric characteristics of the thin-walled sections.

The direct transverse bending. Types of rod bending. The internal force factors and differential dependence in the direct transverse bending. Technique of construction diagrams of internal force factors in the beams. The normal tensions in pure bending. Normal and tangential tensions in the direct transverse bending. Tangential tensions in beams of thin walled cross-section. Bending Center. Calculations on flexural strength. The criterion of rationality of the cross sectional shape on the strength of the beam. The strain energy of the beam in bending. Determination of flexural displacement. Integration of the differential equation of the elastic line. method. The rule of Vereshchagin. Calculation of stiffness coefficients and compliance for beams. Calculation of stiffness. The criterion of rationality of form the cross-sectional stiffness.

Torsion. The internal force factors in torsion. Classification of the cross-sections of rods. Torsion rod of circular and annular cross sections. Torsion rod closed thin-walled cross-section. Torsion rod of solid rectangular cross-section. Torsion of thin-walled rod of open cross-section and a composite section. Generalized formulas for calculating the torsion rods. Differential and Integral dependence during torsion, technique for constructing diagrams for the rod.

Calculations of strength and rigidity during torsion. Criteria of rationality of cross section forms in torsion. The potential energy of deformation. Calculation of the coil springs of small steps.

Slanting bending and an eccentric tension-compression of a straight rod. Slanting bending tension in cross section, the neutral line. Determination of movement. Calculation of the strength and stiffness. Determination of tension under eccentric tension-compression, the equation of the neutral line, sectional core, strength calculation.

Elements of the rational design of the simplest systems. Criteria of rationality of the system. Possible design parameters. Rational design of the systems, the elements of which are working in tension-compression. Rational forms of statically determinate rods with distributed load. Rational distribution of stiffness in the rods system. Rational geometry of the rod system. Rational design of beams. Uniform strength beam. Regulation of the maximum bending moment in the beams, by change the stiffness or position of supports, load position etc.

Statically determinable rod systems. Spatial beam of small curvature, internal force factors and tension in cross-sections, the potential energy of deformation, Mor integral. Types of rod systems. Features of calculation movement in flat rod systems (frames, farms, combined systems) by Mor. Determination of reciprocal movement sections.

Calculation of statically indefinable rod systems by method of forces. Communications. Necessary and excess communications. Equivalent and main systems. Canonical equations of a forces method. Coefficients of the canonical equations. Cargo, single and total states. Check of the decision. Calculation of flat static indefinable frames. Disclosure of static indefinability of frames with the closed contour, the accounting of the cut hinges. Use of direct and return symmetry in frames for disclosure of static indefinability. Features of application of a method of forces for calculation of statically indefinable beams, farms, the combined systems. Application of a method of forces in temperature tasks.

Tensioned and deformed state in a point of the body. Tension state in the body point. The tensor of tension. Components on an arbitrary site of the vector total voltage passing through a given point Full, normal and tangential tensions on this site. The main grounds and the main tensions. Determination values of principal tensions and the provisions of the main sites. Ellipsoid of tension. Extreme tangent tension and platforms of their action. Circular chart of the Mor. Classification of intense states. Analysis of flat tension. The main platforms and the main tension in a rod at difficult loading. The deformed condition in a body point. Tensor of deformations. Analogy between strained and deformed by conditions. The generalized Hooke's law for isotropic material. Specific potential energy of deformation and its division into energies of scope change and form.

Theories of strength. Schematic diagram of the construction of strength theories. The theory of maximum normal tension. The theory of the greatest relative elongations. The theory of maximum tangential tensions. The theory of the specific potential energy and changes forms. Theory of Mor. Comparison of strength theories. Calculation of rodes on strength at difficult tension. Calculation of spatial statically definable and statically indefinable frames. Calculation plainly spatial frames.

Calculation of axisymmetric thin-walled covers for the moment less theory. Geometry of a thin-walled cover of rotation, meridional and district sections. Condition of existence of moment less tension. Concept of regional effect. Rational forms of covers and their connections. The allowing equations of moment less axisymmetric covers: Laplace's equation; the equation of balance of a part of the cover cut by district section. The theorem of a projection equally effective evenly distributed pressure on some surface upon the set direction Tension state at the point of the shell. Examples of calculations for strength of cylindrical, conical and spherical shells.

Stability of compressed rods. The concept of stability loss for a perfect rod. Critical force. Euler task. Comparison of the results of the Euler with other solutions.

Value and disadvantages of the ideal model. The limits of applicability of Euler's formula. Stability of compressed rods outside of proportionality. The dependence of the critical stress of flexibility. Calibration and design calculations for stability. The energy method for the determination of the critical load.

The longitudinal and transverse bending. Features of tasks longitudinal-transverse bending. Various forms of differential equations describing the longitudinal and transverse bending, their integration. An approximate formula for calculating deflections during longitudinal and transverse bending. Determination of the tensions and margin of safety using the approximate formula. Calculation of moving with an acceleration of structural elements

The forces of inertia. Calculation of forward moving systems. Calculation uniformly rotating systems.

Blow. Concept of blow. The mechanical processes accompanying blow. Technical theory of blow. Blow to system without the mass of system. Blow to system which mass is concentrated in a blow point. Reduction of mass of system in a blow point. Elements of rational design of systems at shock loading.

Calculation on durability at a tension which is cyclically changing in time

Fatigue phenomenon. Cycle of tension and limit of endurance. Influence of concentration of tension, sizes, purity of surface treatment and other factors on fatigue resistance. Limiting charts of amplitudes and determination of margins of safety of details from various materials in case of net shift and monoaxial tension. Determination of an stock of fatigue durability in case of difficult tension.

Calculation on strength for the bearing ability. . A concept about calculations for the bearing ability. True chart of tension and her schematization. Calculation for the bearing ability of the systems working for stretching compression. Calculation for the bearing ability of the systems working for a bending.

Section 3. The reinforced concrete constructions

Materials of construction from concrete and armature

The essence of the concrete. The concept of reinforced concrete as the structural composition of the two materials - concrete and steel reinforcement.

Concrete and steel reinforcement as construction materials for reinforced concrete structures

Basic physical and mechanical properties of concrete. Armature for reinforced concrete constructions. Basic physical and mechanical properties of reinforced concrete

Laboratory work №1. Determination of settlement characteristics of concrete and armature destructive and non-destructive methods

Methods of calculation of reinforced concrete constructions for limit states. Experimental data on the reinforced concrete under load, as the basis for the construction of reinforced concrete resistance theory. Fundamentals of the method of calculation for limit states. The general case of calculation strength of normal sections of rod reinforced concrete elements

Practical work №1 . Classification of loadings, collection of loads of overlapping and covering.

Designing and calculation of the bent elements. Design features of the bent elements. Calculation of strength on normal sections of reinforced concrete ele-

ments. Constructive requirements to reinforcing.

Practical work №2. Calculation of strength of the bent elements of any profile for normal and inclined sections.

Calculation of strength for inclined sections of the bent elements having collars and the unbent fittings. Constructive requirements to placement of cross armatures.

Laboratory work №2. Test of a reinforced concrete beam on a bend with destruction on normal and inclined sections

Designing and calculation of the compressed elements. Constructive requirements to the compressed elements. Calculation of elements with casual eccentricities. Calculation of strength of the non-central compressed elements of rectangular and ring section with big and small ex-center systems.

Practical work №3. Calculation the strength of non-centrally compressed and non-centrally stretched elements.

Considering flexibility of non-centrally compressed elements. Calculation and designing of the elements strengthened by indirect reinforcement.

Laboratory work №3. Research of the reinforced concrete column work on the non-central compression.

Preliminary and intense reinforced concrete elements. Essence of preliminary and intense RCC. Ways and methods of the preliminary tension creation. Losses of preliminary tension in armature. Change of the intense deformed condition of usual and preliminary and intense elements from process of production to destruction.

Laboratory work №4. Research of the prestressing effect on the fracture toughness and bends of reinforced concrete beam bent

Designing and calculation of the stretched elements

Design features of the stretched elements. Calculation of strength central stretched and non-central stretched elements.

Bases for calculation of reinforced concrete constructions on deformations

Calculation of crack resistance of reinforced concrete elements. Calculation by training of cracks, normal to a longitudinal axis of an element, central stretched, bent, non-central compressed and non-central the stretched elements.

General provisions for calculating the width of the crack opening. Factors influencing the width of cracks. Calculation of the closing of cracks. General provisions on calculation of deflections.

Practical work №4 . Calculation by formation of cracks centrally stretched, bent and non centrally loaded elements.

Practical work №5 . Calculating the width of the crack opening.

Practical work №6 . Calculating the displacement of elements with cracks and without them.

Reinforced concrete constructions of multistory buildings. Flat overlapping of multistory buildings and their main types - beam and without beam. Construction crossbars beam of overlapping. Bases of calculation reinforced concrete constructions by the method of limit equilibrium. The columns of multistory buildings. The joints of precast concrete structures, their construction and calculation.

Practical work №7 The construction and reinforcement of columns. Design and calculation of reinforced concrete structures joints.

Reinforced concrete foundations of small laying. Classification of reinforced concrete foundations. Construction of prefabricated monolithic separately-standing

bases under columns. Calculating centrally loaded foundations.

Practical work №8. Design and calculation of non centrally loaded foundation.

Constructions of urban engineering facilities (underground crossings, retaining walls, etc.)

Constructive solutions, principles for the calculation, features of the design and reinforcement of urban engineering facilities

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
<p>LO 10 Own the rational design principles of reinforced concrete constructions, taking into account the requirements of manufacturing, assembly and reliability of the operation on the basis of a feasibility analysis.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - the physical and mechanical properties of concrete, steel reinforcement and reinforced concrete; - features of resistance of reinforced concrete elements at various intense states; - bases of design of reinforced concrete elements with purpose of the optimum sizes of their sections and reinforcing on the basis of the accepted constructive scheme of a construction and a combination of the operating loadings; - design features of the main reinforced concrete constructions of industry and civil buildings and constructions; - the principles of configuration of constructive schemes of buildings and constructions from precast and monolithic reinforced concrete; - bases of designing epy joints and connections of prefabricated elements and their calculation; - the main regulating and technical documentation on designing reinforced concrete constructions. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - using the existing standard, technical and reference books, calculate and design the main prefabricated and monolithic reinforced concrete constructions of buildings and structures; - design reinforced concrete constructions; - make strengthening and recovery of these designs

PM.11 Performing calculations and construction of metal structures

Purpose:

This module contributing to the development students for professional careers in the field of metal structures design.

Introduction to the module:

The student should understand basics of working with metal structures of buildings and facilities; principles of rational design of metal constructions taking into account the requirements of manufacturing, assembly and reliability of the operation on the basis of a feasibility analysis.

Module content:

Properties and steel construction work. Construction steel and aluminum alloys: chemical composition, microstructure, properties. Influence of various factors on the properties and fracture (time rate of loading, temperature and aggressiveness of the medium). Types of destruction. Work of metal under loading: single static stretching and compression, difficult tension (the specified tension). Fragile destruction; the factors promoting fragile destruction. Repeated continuous loading, fatigue of metals. The accounting of work features of metal during designing. A concept about a range of primary elements from steel and aluminum alloys. Work of the metal constructions elements and basis of calculation of their reliability. Bases of the calculation method for limit states: purpose of calculation, group and types of limit states, limit inequalities, system of coefficients of reliability: accounting of variability of loadings, resistance of metal and sizes of sections. Operating conditions of constructions, consequences of limiting conditions, responsibility of buildings and constructions. Tension and deformation of condition central, non-central loaded, bent metal rods in elastic and elastic-plastic stages. Stability of central, non-central compressed, the bent-compressed and the bent elements; critical tension, settlement length, flexibility, stability of thin plates.

Connections of metal structures. General characteristic of connections. Welded connections, butt and with angular seams. Designing, work under loading, calculation of butt and angular seams. Bolt connections, bolts of the increased, rough and normal accuracy, high-strength bolts. Designing, work under loading, calculation of bolt connections.

Practical work №1. Designing and calculation of welded connections by butt and angular seams.

Practical work №2 Designing and calculation of bolt connections of various types. Beams, frame designs. Scopes, classification of beams. Configuration of beam overlapping: main schemes, their merits and demerits, configuration optimization.

Design of decks and rolling beams: settlement schemes, definition of loadings and efforts, selection of section, check of strength and rigidity. Design of compound beams: settlement schemes, definition of loadings and efforts, purpose of height of a beam and configuration of rational section, check of strength of sections, ensuring rigidity, general and local stability. Designing and calculation of details, joints and interfaces of beams.

Features the thin-walled, punched beams, beams with a corrugated wall, previously strained beams.

Practical work №3. Check local stability of the section elements of compound beams.

Practical work №4. Selection and check of sections of rolling and welded beams in elastic and elastic-plastic stages.

Central compressed columns. Scopes, classification of columns. Work features of through columns, the given flexibility. The choice type of column section. Design of solid columns: settlement scheme, settlement length, definition of loadings and efforts, configuration of rational section, check of strength. General and local stability. Design features of through columns: definition of columns branches and distance between branches from a condition of equal stability. Stability check of branches and column in general, calculation of a lattice.

Designing, features of work and calculation of the tip and bases of columns.

Practical work. Designing and calculation of details, joints and interfaces of beams. Selection and check of section of central compressed solid and through columns.

Farms. Scopes, classification of farms, determination of the general sizes, unification of geometrical schemes. Definition of loadings and efforts in rods. Design of easy farms of coverings: ensuring the general stability of farms in system of a covering, settlement lengths of rods, the choice section type, selection and check of the rods sections, extreme flexibility of rods. Designing, work and calculation of the factory knots and assembly joints of farms. Features of designing and calculation of heavy farms.

Bases of the building frame design. Total characteristic of frames, constructive schemes. Account in case of design requirements of operation, reliability and longevity, manufacturing and installation of constructions.

Structure of a framework, longitudinal and cross designs, functions and interaction of elements. Optimization of constructive decisions.

Choice the columns grid. Configuration of a cross frame. Choice of the constructive scheme, determination of the main sizes. Configuration of a covering. Composition and covering scheme. Schemes and functions of covering communications during installation and operation. Configuration of the framework longitudinal constructions. Schemes and functions of communications on columns during the installation and operation.

Practical work №5. Configuration of the production building cross frame.

Practical work №6. The choice of the scheme, feature of designing and calculation of covering links and links on columns of the production building.

The work features and the framework calculation. Valid work of the steel framework, justification of the settlement scheme of cross frames and framework in general. Definition of the loadings operating on a framework.

Bases of the framework calculation. The features of the spatial work framework and its account. Determination of settlement efforts in the main sections.

Practical work №7. Definition of the loadings operating on a cross frame of a framework.

Covering elements. Features of rafter farm work as crossbar of a cross frame, determination of settlement efforts in farm elements. Designing, features of work and calculation of hinged and rigid interfaces of a farm to a column. Features of support construction of the rafter farm on subrafter, a subrafter farm on a column. Features of designing and calculation of a subrafter farm, lamp framework. Design, features of work and calculation of solid and through runs

Practical work №8. Selection and check of rods sections of a rafter farm.

Practical work №9. Designing and calculation the knots and joints of a rafter farm.

Framework columns. Constructive schemes of columns, types of sections, possible forms of stability loss and settlement lengths of columns. Design of solid columns: choice of settlement efforts combinations, selection of section, check of durability, general and local stability. Design of through columns: the choice of settlement combinations of efforts, determination of settlement efforts in branches and a lattice, selection of sections, check of stability of branches, a lattice and all column in the plane of action of the moment as uniform core.

Designing, work features and interface calculation of on crane and subcrane column parts, base of solid and through columns.

Practical work №10. Designing and calculation of interface knots of subcrane and on the crane column parts, base of non-central compressed solid and through column.

Subcrane designs. Structure of subcrane designs, types of subcrane beams and brake designs, loadings. Work features and calculation of cut and not cut solid and through sections beams. Design of subcrane beams: the section configuration, determination of settlement efforts, durability and endurance check. Designing, work features and calculation of basic knots of subcrane beams and brake designs. Emphasis, crane rails and their fastening.

Practical work №11. Selection and check the subcrane beam section.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
<p>LO 11 Own the principles of rational designing of metal designs taking into account requirements of production, installation and operation reliability on the basis of the technical and economic analysis.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - development tendencies of the metal constructions constructive forms; - method of metal constructions calculation in limit states; - rules of the connections calculation of the elements nodes; - rules of the metalwork constructing taking into account requirements of manufacture, transportation, mounting and technical operation. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - choose material for designs and their elements taking into account requirements of the design norms; - make the design constructions schemes of different forms and the scheme of their arrangement, develop knots of the elements connection; - define load on constructions and efforts in elements; - select recuts of elements, check their strength, firmness and rigidity.

PM.12 Studying the bases of marketing researches

Purpose:

To teach future specialists to specifics of the goods promotion in the market of industrial function, using the modern strategy and the principles of modern marketing.

Introduction to the module:

Studying of the module promotes mastering students a capability to independently learn new research methods, to change a scientific and scientific-production profile of the professional activity, to change sociocultural and social conditions of activities.

Module content:

Classification of industrial goods. Differences of the industrial function goods

marketing from consumer goods marketing. Marketing environment and marketing information system. Basic principles of market segmentation of industrial output. Entities commodity policy features of industrial sectors. Content of the goods distribution channels of industrial function. Basic principles of the manufactured goods pricing. Features of communicative policy of industrial and food products. Features of marketing strategy on industrial enterprises. Main function blocks of marketing strategy. Main directions of marketing researches. Main content of structure of a marketing plan and sequence of its development. Types of marketing plans.

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
<p>LO 12 Distinguish concepts of marketing management</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - principles of strategic and tactical planning; - activities of the marketing specialist; - work principles with media; - principles of the budget forming and planning the work of the marketing specialist; - the action systems in case of the crises permission in the organization; - valuation principles of overall performance of promotion department and public relations; - the fundamental laws and bylaws of RK, regulating and regulating a marketing activity in RK - the principles of creation and registration of materials for expert opinions and reports; - assessment of methodology and selection of innovative projects - about collection and systematization of scientific – practical information on a subject of researches in the field of marketing, advertizing and PR. - methodology of carrying out market observations, polls of questioning, an experiment for the purpose of increase the image and a competitive line item in the market. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - set the purposes and formulate the tasks connected with implementation of professional functions; - use information obtained as a result of marketing researches; - carry out complex and situation analysis of a competitive environment of the organization; - make decisions in a condition of a stress and limited control of time; - own skills of an expert evaluation of strategic planning; - apply methods of the quantitative analysis and modeling, theoretical and pilot study; - develop and realize the main marketing programs; - find improvement ways of the existing designs, technologies or materials for the purpose of increase the products competitiveness; - determine methods of use the latest developments of science and technology for creation the new competitive products; - carry out analytical works on generalization of experience of competitors and a research of a market conjectures; - carry out model developments, carry out experimental and test works

PM. 13 Organization of events for resource conservation in the production of building materials

Purpose:

Studying of the main problems of resource-saving, indicators of resource-saving and resource use, possibility of rational use of natural and resource capacity of the country.

Introduction to the module:

This module will help to seize the main directions of the technogenic waste use in the construction industry, energy saving, the basic principles of formation the progressive resource-saving technology.

Module content:

Introduction to resource-saving problems. Main terms and concepts. Purposes, tasks and requirements of resource-saving. Main indicators of resource use and resource-saving.

Natural and secondary resources. Natural resources. Assessment of natural resources and natural - resource potential. The major factors exerting impact on natural - resource potential. Rational use of natural - resource potential. Secondary resources. Main terms and concepts. Classification of waste and by-products. Problems of storage and methods of utilization of technogenic waste. System of accounting the technogenic products. Natural raw materials and technogenic waste as technical - economic and ecological alternative. The generalized scheme of a complex interconnected non-waste and low-waste productions. The main directions of use the technogenic waste in the construction industry.

Energy saving. Main terms, concepts and indicators. The main directions and methods of energy saving in the construction industry. Increase in efficiency of thermal installations. Optimum modes of thermal treatment. Low-power-intensive methods of the curing acceleration. Technology solutions and ecology of the construction materials production. Problems of improvement the technological process (reducing a production cycle, decrease in temperature, time and temperature of thermal treatment, etc.). Basic principles of the progressive technology forming. Semantic and quantitative criteria of the progressive technology achievement. Optimizing factors in case of enhancement technology. Ecological aspects in case of production construction materials, products and designs. Sanitary and hygienic safety of the construction materials production. "Vital" cycle of construction materials. Classification of danger sources of construction materials at all lifecycle stages. Control of ecological safety at all stages. Regulating documents, public services and their functions. The principles of choice the construction materials taking into account technical and economic and ecological preference

Learning outcomes After successful completion of this module, the student shall:	Assessment criteria Student shall
<p>LO 13 Own the principles of independent solution the tasks on resource-saving in the field of production, the choice and application of the wide nomenclature of traditional and new construction materials taking into account effective scientific - technical and technological developments.</p>	<p>KNOW:</p> <ul style="list-style-type: none"> - main indicators of resource-saving and resource use; - the factors exerting impact on natural and resource potential; - classification of technogenic waste and by-products, main directions of their conversion; - the main directions and methods of energy saving in the construction industry; - the main ways of increase in production efficiency of construction materials; - bases of an ecological safety in the production technology of construction materials; - the danger sources of construction materials at all stages of lifecycle; - the principles of the construction materials choice taking into account technical - economic and ecological preference. <p>BE ABLE TO:</p> <ul style="list-style-type: none"> - rational use natural - resources potential; - theoretically and experimentally estimate possibilities of use the local raw material resources and waste of the industry during creation of effective materials; - constitute technological schemes of progressive non-waste and low-waste productions; - perform the actions directed on power - and material saving in production of construction materials; - carry out a quality evaluation of harmonious construction materials taking into account technical and economic and ecological preference.

7. Curriculum

technical and vocational, post-secondary education

Specialty:

1413000 – « Production of concrete and metal products (by type) »

Qualifications:

Steelfixer - welder
Moulder –concreter - hookman
Technician - technologist
Junior production engineer

Mode of study: full-time

Normative period of training: 4 years 10 months
on the basis of general secondary education

with getting a qualification: Technician – technologist 3 years 10 months
On the basis of fundamental secondary education **2 years 10 months with getting a qualification:**
Junior production engineer+ 10 months

Index	Name of modules, practices	Form of control			Amount of teaching time (hours / credits)			Distribu- tion by se- mesters
		exam	credit	Course paper	total	Theoretical study	Among them Practical study	Industrial study
1	2	3	4	5	6	7	8	9
GEM	General education modules				1448			10
PM.00	Professional modules							

BGPM. 00	Basic general professional modules				484	334	150	180	
BGPM.01	Transportation of cargo of the various kinds		+		184	124	60	72	2-4
BGPM.02	Laboratory tests for the quality control of materials and products		+		100	70	30	36	2-4
BGPM. 03	Quality control of reinforcement and metal products and structures		+		100	70	30	36	2-4
BGPM. 04	Quality control of reinforced concrete products		+		100	70	30	36	
PM. 00	Professional modules				300	225	75	288	
	Qualification: «Steelfixer - welder»								
PM.01	«Moulder –concrete - hookman» Production of reinforcement products		+		60	45	15	60	3-4
PM.02	Production of reinforcement and metal structures	+			105	75	30	96	3-4
PM.03	Production of concrete mixture		+		60	45	15	60	3-4
PM.04	Production of reinforced concrete products	+			75	60	15	72	3-4
	Qualification: «Technician - technologist»			80	368	194	94		
PM.05	Study of the basic properties of building materials and structures				70	38	32		5-6

PM.06	Organization of the production process of concrete and metal products and structures	+		30	132	60	42		5-6
PM.07	Organization, planning and management of the enterprises of building products and structures	+		20	52	22	10		5-6
PM.08	Automation of production processes of concrete and metal products and structures	+		30	72	32	10		5-6
PM.09	Organization of Standardization, Certification and Accreditation in the factories of concrete and metal products		+	42	32	10			5-6
	Qualification: «Junior production engineer»								
BM.00	Basic modules			1363					
SEM 00	Socio-economic modules			286					
	Professional modules			80	635	357	198		
PM. 10	Calculations and design of reinforced concrete structures.	+		30	302	178	94		7-10
PM. 11	Calculations and design of metal structures.	+		30	139	69	40		7-10

PM. 12	Market researches and identification of needs in producing new products.	+		20	97	50	27		7-10
PM. 13	Organisation of measures for resource conservation in the production of building materials	+			97	60	37		7-10
MO	Modules defined by the education organization				48	48			10
PP 00	Industrial Training and Professional Practice				1836				
PP. 01	Practice in learning and practice classes				72				2-4
PP. 02	Practice for a work profession Moulder –concreter - hookman				288				2
PP.03	Practice for a work profession Moulder –concreter - hookman				108				3-4
PP. 04	Industrial				576				5-6
PP. 05	Technological				288				8
PP. 06	Pre-graduation practice				216				10

PP. 07	Graduation project						288					10
IA	Interim assessment						360					
FA	Final assessment						72					
FA. 01	Assessment in educational institutions						60					
FA. 02	Assessment of the professional training level and conferring of qualification						12					
	Total for compulsory education						7200					
C	Consultations						no more than 100 hours for the academic year					
O	Extracurricular activities						not more than 4 hours per week					
	Total:						8264					

Note:

practical training include practical (laboratory) works, course papers, tests and other.

- 1) When developing and implementing working curriculum and programs, the technical and vocational education organizations may:
 - change up to 30% of the studying time devoted to master educational material for cycles and up to 30% in each subject (module) and up to 50% of the industrial 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 to 30% in humanities and socio-economic modules and up to 50% in professional modules, industrial training and professional practice. Introducing additional modules in

vocational modules as employers will demand, while maintaining the total number of hours/credits for compulsory education;

- select the form, procedure and frequency of ongoing monitoring of students' progress and interim assessment;

2) The courses distribution may vary depending on the learning technologies, specialty specifics, regional features and others.

8. Explanatory note

The explanatory note to the curriculum in the specialty 1413000 "Production of concrete and metal products (by type)" contains a description of the curriculum in accordance with the state compulsory standards of respective education levels in accordance with the requirements of SCES RK (DG RK No.1080 of 23.08.2012) .

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

The most important component of the program is the emphasis on practical training of students. To do this, special modules and industrial training should be combined in developed curricula. That is, if the model curricula (MC) allocate the industrial training alone, and relates to professional practice, and in the programs developed it is distributed to the professional modules.

The development of professional modules can be scheduled with the first course in parallel with the implementation of compulsory modules programs.

The curricula aimed at **vocational training**, include:

- 1) study of general subjects and modules;
- 2) performance of laboratory and practical classes on general subjects and modules;
- 3) industrial training and professional practice;
- 4) course and diploma projects (papers).

The educational process in educational institutions implementing the curricula of technical and vocational, post-secondary education includes theoretical classes and industrial training to be performed in the learning and practice classes, educational farms and training grounds under the guidance of the master of vocational training, and directly on the production and organization of the appropriate profile.

The professional practice is carried out in the respective organizations, in the workplace, provided by employers under the contract, and is aimed at the formation of professional competencies.

The practical training (laboratory and practical classes on general subjects, modules, disciplines (modules), defined by the education organization; industrial training and professional practice, course and diploma projects) should be at least 40% of the total study time of the education period (excluding general and socio-economic disciplines).

The curriculum of technical and vocational education with the dual training include theoretical training in educational institutions and at least sixty percent (60%) of the industrial training, practice at the premises of the enterprise.

Course projects (works) are regarded as one of the types of training activities on general professional and special subjects/ modules and carried out within the study time devoted to their study. Number of course projects (papers) in the semester is not more than one. The duration of Additionally allowed to plan a course work (project).

The time allowed for diploma projects should not exceed 6 weeks. The duration of pre-graduation (qualification) practices is planned, depending on the complexity of the specialty.

To take into account regional characteristics and requirements of employers to the staff training by the specialty, the study of *courses/modules* are provided, *de-*

fined by educational organizations.

To determine the students' mastering quality of educational programs in the curriculum, **interim and final assessments** are provided.

The *interim assessment* conducting is provided in all subjects/modules, which main forms are exam, credit, test.

The interim assessment in general educational disciplines provides for examinations in: language, literature, history of Kazakhstan, mathematics and the choice of a technical and vocational education organization.

Number of examinations, credits and tests on the humanities, social and economic, general professional disciplines, modules is determined based on the requirements to the level of knowledge, skills and competences the student should have.

Tests and credits are carried out at the expense of study time allocated to the study of this discipline (module), exams - in the time allocated to the interim assessment.

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).

The final assessment of students of technical and vocational education institutions includes:

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

The final certification of students in educational institutions is carried out to determine the level of student's mastering of educational programs on the basis of the full course of study.

Possible forms of the final assessment in educational institutions on the basis of completion of educational programs: passing of examinations in general professional subjects (modules) and special modules, or performance and defense of the graduation project, or the performance and defense of the graduation project with passing an examination of final assessment in one of the special subjects (modules).

Assessment of the professional training level and conferring of qualification (hereinafter - APTLCQ) by specialties consists of two phases:

- 1) theoretical test on disciplines (modules), defining professional training;
- 2) implementation of practical tasks by skill level.

The study time amount to carry out the final assessment is determined by no more than 2 weeks. Among these, the organization and conduct of APTLCQ give at least 12 hours per group (depending on the specialty specifics and the organization of educational process it may vary upwards).

Consultation and extracurricular activities are aimed at ensuring the individual abilities and requests of students.

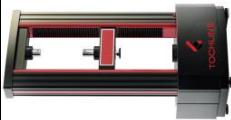
Extracurricular activities are provided for the entire period of study of the rate of not more than 4 hours a week and are not required to be studied by students.


Consultations are provided in the amount of up to 100 hours per academic year depending on the specialty and studying period per a study group.

The amount of time and form of consultation (group, individual, written, etc.) are determined by educational organizations when drafting the working curriculum. When developing model curricula it must be considered that:



- academic year begins on September 1 and ends according to the educational process organization related to the specialty specifics;
- vacation time is 11 weeks per year, including the winter - not less than 2 weeks, except for military specialties. Students who have concluded an agreement on dual training with a company, during the holidays may do an internship in enterprises;
- the maximum volume of students' academic load is not more than 54 hours a week, including the compulsory academic load at the full time education - at least 36 hours a week (upon that the specified amount does not include classes in optional subjects and consultations).


9. The list of the recommended equipment


No.	Name	Technical specifications	Purpose of the equipment / Covered subjects	The module (s) in which the equipment is used	Comments
Machine tools					
1	Universal testing machine TPM - 300.	<p>- Range of measured load, kN: 2.3 - 300;</p> <p>-type force measuring sensor - tensoresistance;</p> <p>Load measurement accuracy: $\pm 1\%$ of reading down to 1/230 of the maximum limit load-strain sensor; Graduation smallest measuring discharge at measuring the movement</p>	<p>Universal Testing Machine series of two-zone two column TPM-30 designed for setting and measuring the compression force or stretching, as well as measurements of displacement of the movable part of the loading unit during the mechanical test samples. Designed for mechanical testing of materials in tension, compression, bend, slump, flattening, permanent deformation,</p>	<p>1. Carrying out laboratory tests for quality control.</p> <p>2. Production of reinforcement products</p>	



		of the moving traversy 0,001 mm bimensions, mm 800 × 330 × 1730	peeling, fibering, chipping, rending and others within the technical capabilities of the machine.		
2	Hydraulic press	<p>The limits of force measurements, tf: 3-30 Deviation, %: ± 2 Speed of compression support, mm / min: 0-20 The length of working stroke of compression support, mm 0-30 Total power, kW: 1.0 The size of base plates, mm: 320 x 320 Overall dimensions: 1200 x 1000 x 2200 Weight, kg: 800 complete with additional steel plates.</p>	<p>The machine, serving for static tests of standard samples of construction materials due to the made effort to them, and also the brick test to a cross bend.</p>	<p>1. Laboratory testing for quality control. 2. Production of concrete mix</p>	




3	the device and the adaptation for tests on stretching at a bend			Laboratory testing for quality control	
4	Indicator heads ICH	Division price 0,01 mm	for linear displacement measurement	1. Quality control of RCP and structures	
5	Micrometers 30 mm	up to 0.03 micrometer	for linear dimensions measuring absolute or relative contact method in the field of small size with low accuracy (from 2 micrometers to 30 micrometers, depending on the measurement range and accuracy class), transformative	1. Quality control of RCP and structures	
6	Stopwatch	error for accuracy class 2 it is approximately +/- 1 second per 30 minutes	a device capable of measuring time intervals accurate to fraction of a second	1. Making the concrete mix	



7	Scales electronic general-purpose desktop series of MK-A	Maximum weighing 3 kg. Discreteness reading (in the range of weighing) 1 g. The highest limit of the sample tare mass of 0.3 kg. Dimensions 323x310x36 mm.	designed for static weight measurements.	Laboratory testing for quality control	
8	Scales electronic desktop MK-6.2-A22	Weighing around 13 kg. Discreteness reading (in the range of weighing) 2 g, the largest sample limit tare mass of 1.3 kg. Dimensions 323x310x36 mm.	designed for static weight measurements.	1. Carrying out laboratory tests for quality control. 2. Module: 1. Making the concrete mix	


9	Scales electronic desktop MK-32.2-A22	<p>Greatest limit of weighing 32 kg. Discreteness reading (In the range of weighing) '10 g. The largest sample limit tare mass of 7.3 kg. Dimensions 323x310x36 mm.</p>	designed for static weight measurements.	1. Making the concrete mix	
10	Scales for static weighing	at the cost of division no more than 1 g		Laboratory testing for quality control	
11	Wire liner	internal diameter is 150 mm and height is 150 mm with a removable bottom and a plunger.		1. Making the concrete mix	
12	Jaw crusher of laboratory brand DLShch 60'100			1. Making the concrete mix	


13	cupboard		Working chamber volume 80 l. Operating temperature range 30 330 ° C. Deviations from the set temperature for the camera volume of ± 1 ° C. Heating time to maximum temperature 60 min. Forced convection available. 16h of continuous work time. Size of working 360h200h360mm the camera.	for drying products and materials in the laboratory for the shortest possible time.	1. Carrying out laboratory tests for quality control 2. Making the concrete mix	
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14	Forced action mixer	<p>Stirred mixture volume is 13 liters. mixing cycle 13 - 60 seconds (timer).</p> <p>Electrical power 380 V / 0,33 kW. Dimensions of 60 x 80 x 110 cm. The weight 60 kg</p>	<p>intended for making concrete and other mixtures.</p> <p>While stirring excluded crushing aggregate due to a floating installation of the mixer blades.</p>	Laboratory testing for quality control	
15	Laboratory instrument WIKA.	<p>The needle Diameter of 1,1 ± 0,02 mm Diameter of pestle 10 ± 0,03 mm the needle length 30 ± 1 mm</p> <p>Weight of slide rod assembly with a needle, and pestle 300 ± 2 g</p> <p>Height of the ring 20 ± 0,2 mm Dimensions 130 x 130 x 260 mm, weight 1.3 kg</p>	<p>device for determining the normal density cement paste and timing of cement paste setting (GOST 310.3-76).</p>	1. Making the concrete mix	


16	Device DDS (cone of Central Research of construction industry)	<p>Cone angle - $30^{\circ} \pm 30'$</p> <p>Price scale division - 1 mm</p> <p>The weight of the movable rod - 300 ± 2 g</p> <p>Size: 286 x 230 x 760 mm.</p>	for the establishment of normal density of the solution and the mobility of solution mixture under laboratory conditions in accordance with GOST 3802 "Construction solutions. Testing methods."	<p>1. Carrying out laboratory tests for quality control</p> <p>2. Making concrete mix</p>	
17	Bowl for mixing BM	<p>Outer diameter: 200 mm</p> <p>Height: 100 mm.</p> <p>Weight: 2.6 kg.</p>	intended for the preparation of cement paste under laboratory conditions according to GOST 310.3-76	1. Making concrete mix	
18	Standard cone (Abrams) CA	The set consists of a funnel and the increased rigidity cone. Material of the cone and funnel - St3, powder painting.	Designed to determine the workability of the concrete mix	<p>1. Making concrete mix</p> <p>2. Carrying out laboratory tests for quality control.</p>	


19	VB-1 device	Lower cone diameter: 200 mm. Upper cone diameter: 100 mm. Maximum fineness of filler: 20 mm. Dimensions: 300 x 360 x 660 mm.	for determining the rigidity, the workability of the concrete mixture.	1. Carrying out laboratory tests for quality control 2. Making concrete mix	
20	Shovel for mixing binding materials.	Weight: 0.3 kg.	Shovel is used to make cement mortar in the laboratory.	1. Making concrete mix 2. Carrying out laboratory tests for quality control.	
21	Defectometer 6			Quality control of concrete goods and designs	
22	the reference microscope MCB-2			Quality control of reinforced concrete products and structures	




23	Camera Universal steaming CUS-1	<p>The maximum number of single temporarily forms in the test samples</p> <p>-100 * 100 * 100mm 22 pcs</p> <p>-130 * 130 * 130mm 13 pcs</p> <p>The temperature of water (steam) .The 18-100°S</p> <p>Control Area to 99 hours.</p> <p>39 min</p> <p>Supply voltage 220 V</p>	<p>intended for:</p> <ul style="list-style-type: none"> - Concrete heat treatment in the determination of its compressive strength in accordance with GOST 22783, - Steaming concrete samples in the selection of heat treatment regimes with a rise in temperature, exposure (isothermal heating) in accordance with GOST 10180, - Testing of cement samples according to GOST 310.2. - Determination of the thermal conductivity of grains of coarse aggregate in accordance with GOST 9738, - defrosting concrete samples according to GOST 23283. 	Carrying out laboratory tests for quality control.	
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24	Climate chamber KRK-200 Ilka	<p>Temperature range: -30 to + 100 ° C. Rated useful capacity: 200 dm³.</p> <p>Dimensions of useful volume: 720 x 860 x 620 mm.</p> <p>The doorway to the world: 720 x 860 mm. heating time from 0 ° to + 100 ° C: not more than 1 hour.</p> <p>Cooling time from +20 to - 30 ° C: not more than 3 hours. The rate of change:</p> <ul style="list-style-type: none"> - Cooling in the climate regime: up to 0.6 K / min; - Cooling in the temperature range up to 2 K / min; 	It is intended to simulate climatic environmental conditions.	<p>1. Carrying out laboratory tests for quality control.</p> <p>2. Making concrete mix</p>	
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				<ul style="list-style-type: none"> - Heating: 2 K / min. <p>Cooling type: water.</p> <p>Refrigerant: R12.</p> <p>Humidity:</p> <ul style="list-style-type: none"> - Humidification: evaporation;- dehumidification of air: air-cooled; - The total temperature range of the wet-bulb temperature: from 2.3 to 80 °C; - relative humidity range: 10 to 93%. <p>Regulation:</p> <ul style="list-style-type: none"> - Electronic control with digital setpoint input for temperature and wet bulb 			
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		<p>temperature;</p> <p>- An electronic control for the dryer and the temperature of the humidifier, and the water level. Mass: 370 kg.</p> <p>Dimensions: 1200 x 2103 x 1070 mm. Energy: 380 V, 30 Hz three phase.</p>			
25	Measuring cylindrical vessels	made of galvanized steel and coated with paint to prevent corrosion. Messel bundle consists of four cylinders, capacity 1l, 2l, 3l, 10l. Reserve fineness of filler: 3, 10, 20 and 20 mm, respectively. The inner	designed to determine the volumetric bulk weight of sand or rubble fractions (gravel) in accordance with GOST 9738.	<p>1. Carrying out laboratory tests for quality control.</p> <p>2. Making concrete mix</p>	


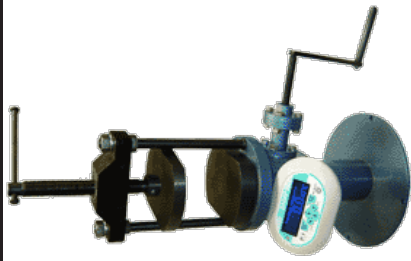
		diameter of the cylinders 108, 137, 183, 232 mm. Cylinder height: 108, 136, 186, 233 mm			
26	Laboratory shaking table LST with manual control	Weight of moving parts 3.3 kg. The height of the fall moving parts: 10 mm. Adjusting the height of the fall: the screw. Table drive: manual.	to determine the normal density of the solution (of concrete) according to GOST 310.2.	1. Carrying out laboratory tests for quality control. 2. Making concrete mix	
		Dimensions 260 x 200 x 263 mm. Weight: 12,3 kg; d is 200 mm.			

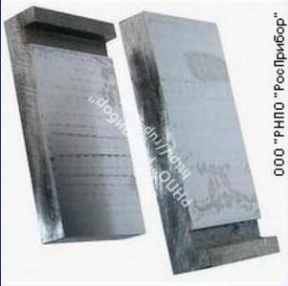

27	Sieve for determining the cement grinding fineness	Grid number 008V. The size of cells in the light: 0.08 x 0.08 mm. Weight: 0,73kg. Dimensions: - outside diameter of the shell 118; - total height 86.	It is designed to determine the fineness of cement grinding in accordance with GOST 310.2-76.	1. Making concrete mix	
28	A standard set of sieves for inert materials.	Panel dimensions: 0.071, 0.08, 0.12, 0.313, 0.63, 0.9, 1.23 mm. diameter of 200 mm. with a tray and a lid made of galvanized steel	Set of sieves LO-231 for the cement and mineral powder, sand.	1. Making concrete mix	
29	SMM Device (mechanical sieve).	Principle of operation: mechanical sieving. Motor: AOL-011-2, power 30W. Number of shakes dial sieves in minutes: 278.	The instrument is used for the screening cement to determine the fineness of cement grinding in accordance with GOST 310-60.	1. Making concrete mix	



		<p>dial rotational speed sieves: not less than 26.3 rev / min.</p> <p>Set consists of two sieves number 02 and 008.</p> <p>Dimensions: 610 x 310 x 382 mm.</p>			
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30	Hammer				Carrying out laboratory tests for quality control.	
31	Laboratory circle abrasion LCA 3	<p>At the same time the test is performed of two samples.</p> <p>The average radius friction: 170 mm. disc rotation speed on the medium. friction radius: 30 m / min.</p> <p>Number of the test samples: 2.</p> <p>The dimensions the test samples _ : 70.7 x 70.7; 30 x 30; 28 x 28; 23 x 23 mm.</p> <p>The height of the test samples: 6-70,7 mm. Test load: 30; 13; 13.822; 3,172 kgs. Motor power: 0.6 kW.</p>	<p>it is intended for testing of concrete and ceramic tiles for attrition in vitro</p> <p>Testing of concrete samples is carried out according to requirements of GOST 13087-81, testing of tiles ceramic in accordance with GOST 27180-86.</p>	Carrying out laboratory tests for quality control.		


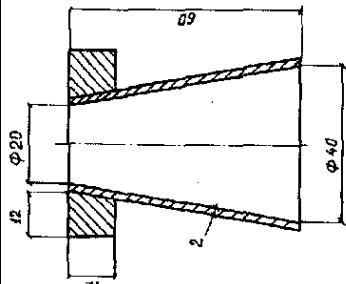
		<p>Weight: 90kg. Size: 792 x 680 x 383.</p> <p>The load on the sample abrasible,: 0.06 MPa. The way traversed by the sample during the abrasion (3 cycles). 130 m Power supply: 380/220 V.</p>			
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32	Probes				Carrying out laboratory tests for quality control.	
33	Bath with hydraulic lock BHL for storage of cement samples	Material: galvanized steel. Mass: 6 kg. Size: 123 * 226 * 306 mm.	intended for storage of cement samples in wet conditions according to GOST 310.3-76.		1. Carrying out laboratory tests for quality control. 2. Making concrete mix	
34	Manual hydraulic press (desktop) type of PHP-1	The range of measured load 1 ... 10 kN. the base plates Size (mm) 123 x 110. Dimensions in mm WxDxH no more than 300 x 200 x 600 Weight, not more than 33 kg.	for visually controlled static testing samples of construction materials, cement and lime beams 2 x 2 x 16		1. Carrying out laboratory tests for quality control. 2. Making concrete mix	

35	Plates for the compression test samples halves - beams.	<p>- Steel hardness 36 ... 61 HRCe</p> <p>- Dimensions 73 x 20 x 23 mm</p>	Pressure plate type PLB are designed to transfer the load in half-beams samples according to GOST 310.2.	<p>1. Carrying out laboratory tests for quality control.</p> <p>2. Making concrete mix</p>	
36	Vibroplatform laboratory of SCV 339 type	<p>Load capacity up to 100 kg, 2800 Frequency oscillations. 2800 t./ Min</p> <p>Oscillations vertically directed, oscillation amplitude 0,13-1,0 mm</p> <p>Vibrator type IV-101.</p> <p>Power 0.23 kW. Mass 103 kg. Dimensions 380 x 200 x 320 mm. Energy 220/380 V, 30 Hz</p>	<p>it is intended for consolidation of concrete and solution mixes in case of:</p> <ul style="list-style-type: none"> • determination of rigidity, density and peelability; • production of control samples for concrete testing in accordance with GOST 10180-78; • testing of cements in accordance with GOST 310.2-81. 	Carrying out laboratory tests for quality control.	



37	Shelf drum KP 123	<p>The set for tests are delivered 12 steel balls weighing 203 ± 10 g, 28 mm in diameter. Inside the drum the size of 700 x 300 mm, with power, water 1.3 kW. The rotation rate of 30 ± 2 rev / min. Dimensions 1360 x 1020 x 1220 mm.</p>	<p>It designed to determine the abrasion of rubble (gravel) in accordance with GOST-8269-</p>	<p>Carrying out laboratory tests for quality control.</p>	
38	Laboratory forms to:	<ul style="list-style-type: none"> - beams 4 x 4 x 16cm - forms for cubes 13 x 13 x 13 cm. - - // - 20 x 20 x 20cm. - - // - 7 x 7 x 7 cm. 	<p>Manufacturing the samples</p>	<p>Carrying out laboratory tests for quality control.</p>	
39	digger			<p>Carrying out laboratory tests for quality</p>	


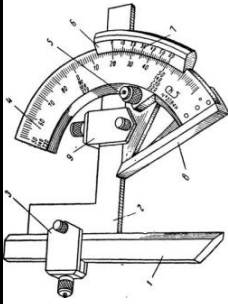

					control.	
40	Mixer for the preparation of cement paste	Number of cement paste, being prepared in a single cycle 200 g Duty cycle 3 min Motor power 0.13 kW. Weight, kg 32. Dimensions 300 x 200 x 330 mm. Energy 380V 30Hz	Preparation of cement paste during testing in a laboratory according to GOST 310.2-81	Making concrete mix		
41	Tank for boiling TB		Boiling test for uniformity of measuring the volume of cement cakes GOST 310.3-76	Carrying out laboratory tests for quality control.		

42	The funnel VOC	Dimensional volume of the vessel: 1 L. The diameter of the screen openings 3 mm. Weight: 2 kg. Dimensions: 310 x 310 x 223 mm.	used to determine the bulk density of sand in accordance with GOST 8733-88 in the laboratory.	Carrying out laboratory tests for quality control.	
43	mini-cone	made of stainless steel or resistant plastic. The inner side of the cone should have a smooth surface with a roughness in accordance with GOST 2789-73 is not more than 1.6 micron. The upper diameter 20 mm. The bottom diameter 40 mm. Height 60 mm. All dimensions are internal.		Carrying out laboratory tests for quality control.	

44	porcelain spoon or spatula stick glass D = 3 ... 5 mm, glass plate 300 × 300 mm.				Carrying out laboratory tests for quality control.	
45	Agama - 2RM.	Vacuum gage pressure in the instrument camera: at least 0,06 MPas. The effort necessary for creation of working rarefaction in the camera: no more than 300 N. the range of measurement: - material resistance to air penetration: from 0,1 to 999,9 with/cm ³ ; - concrete brands on water resistance: from 0 to 20.	the device for the accelerated definition of water tightness of concrete		Carrying out laboratory tests for quality control.	

		Price of division of the reading device: 0,1 with/cm3. The power consumed by the accumulator rectifier: no more than 18 Watts. A limit of the allowed relative error of determination of resistance of material to penetration of air: doesn't exceed 8%			
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46	Measurer of concrete strength IPS-MG4.03	Range of measurement of durability, Mpa3 - 100. Limit of an error of measurement of durability no more than 8%. Quantity of individual calibration dependences-20. Time of one cycle of measurement 13-30 s. Overall dimensions 173*90*30mm. Weight with the sensor is 1 kg.	it is applied to operating and laboratory control of durability and uniformity of concrete, solution, a brick, method of a shock impulse in accordance with GOST 22690.	Carrying out laboratory tests for quality control.	
47	A set of standard mills with direct and screw teeth, integral, assembly, cylindrical trailer, face, shponochny,			Quality control of metal products and designs	

	disk, angular, shaped.				
48	Semenov universal goniometer				 <p>Quality control of metal products and designs</p>
49	Caliper				 <p>1. Laboratory testing for quality control. 2. Production of reinforcement units 3. Production of</p>

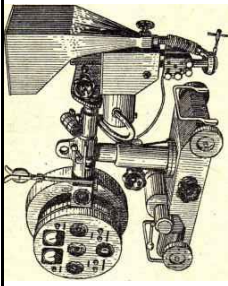
					concrete mix 4. Quality control of concrete goods and designs 5. Quality control of metal products and designs.	
50	Roulette				Quality control of concrete goods and designs	
51	tap				Quality control of metal products and designs.	
52	A set of spiral drills with cylindrical and conic shafts				Quality control of metal products and designs.	

53	protractor				Quality control of metal products and designs.	
54	Ruler metal				1. Laboratory testing for quality control. 2. Production of reinforcement units 3. Production of concrete mix 4. Quality control of concrete goods and designs	
55	Set of visual and measuring control				Quality control of metal products and designs.	

56	samples of welded details.				Quality control of metal products and designs.	
57	light meter "TKA-PKM"				Quality control of metal products and designs.	
58	Ultrasonic defectoscope UD 2-140				Quality control of metal products and designs.	
59	set of samples with artificial defects (SOPs).				Quality control of metal products and designs.	
60	sanding paper, the contact liquid brush.				Quality control of metal products and designs.	
61	Universal Hardness DuraVision 200/300, EMCO-				Quality control of metal products and designs.	

	TEST, Austria;					
62	Machine cutting Labotom-5 Struers A / S Denmark;				Quality control of metal products and designs.	
63	machine grinding and polishing Mora-160E, LAIZHOUHUAYI NNENINGINSTR UMENTCO., LTD, China				Quality control of metal products and designs.	
64	magnifier				Quality control of metal products and designs.	
65	Welded samples from St3 and 15 x 5m,				Quality control of metal products and designs.	

66	an etching solution				Quality control of metal products and designs.	
67	paste for polishing				Quality control of metal products and designs.	
68	sanding paper number 0-6				Quality control of metal products and designs.	
69	electrodes of different brands with a diameter of 3 ... 5 mm				Quality control of metal products and designs.	
70	low carbon steel plate St3sp size of 4 25 100 mm				Quality control of metal products and designs.	
71	posters – schemes of welding posts,				Quality control of metal products	

	devices of welding machines, types of welded seams and connections, technology of manual arc welding				and designs.	
72	automatic machines for arc welding of ADS-500, ADS-1000,	it is calculated on welding current from 200 to 1000 and an electrode wire with a diameter from 1,6 to 5 mm. Welding speed the tractor from 16 to 126 m/hour at a speed of giving of a wire from 52 to 403 m/hour. Speed of welding and speed of giving of a wire is regulated by replaceable	It is intended for automatic welding under gumboil a direct current of butt and angular connections at a thickness of metal from 3,0 to 30 mm. Welding is made by an electrode wire with a diameter of 1,6 — 2,5 mm with a speed from 15 to 70 m/hour. Speed of giving of a wire doesn't depend on length of an arch and can change ranging from 1,8 to 7,0 m/min.	Production of reinforcement and metal products and structures.		

		gear wheels. The tractor has the correcting mechanism for the direction of an electrode on a seam during welding and for a cross inclination of a head with a mouthpiece when welding angular seams. Tractor weight without wire of 42 kg, the weight of an electrode wire is 8 — 10 kg, the capacity of the flux bunker is 4,5 dm ³ (10 kg of gumboil).	Adjustment of speed of welding and giving is made smoothly by change of turnovers of the electric motor Welding ADS-1000-2 tractor (figs. 78) treats universal automatic welding machines. It has automatic control of a feed rate of an electrode depending on tension on an arch. The ADS-1000-2 tractor is delivered with the TSD-1000-3 transformer. Force of welding current is regulated by the remote buttons located on the tractor control panel. Speed of welding changes smoothly by change of speed of the engine of a direct	
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			<p>current.</p> <p>Top part of the tractor rotary. It gives the chance to conduct welding both in a track of wheels, and out of her.</p> <p>The tractor is intended for welding the roller and butt seams with cutting and without cutting of edges at a thickness of metal from 6 to 30 mm.</p> <p>Welding on this tractor is made by an electrode wire with a diameter from 3 to 6 mm with a speed of its giving from 0,5 to 2,0 m/min, at welding current 400 — 1200 at a speed of welding from 15 to 70 m/hour.</p> <p>The weight of the tractor is 65 kg</p>		
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			without electrode wire and gumboil. The weight of an electrode wire is 12 kg, gumboil weight in the bunker of 12 kg.		
73	devices for the control of welding	Control of the mode of welding consists in check of force of welding current, order of suture and cleaning of slag before imposing of each subsequent layer of a seam. For control of the mode of welding and control for the required current the generator is supplied with the mechanical index which error with a rated voltage	At selection and control of the mode of welding directly in a workplace the elementary technological tests are applied. For example, two plates of the set thickness cook on length several points, and then the received sample collapses in a vice a chisel. When welding metal more than 2 mm thick test of a welded point for twisting Use the system automatic control and control of the modes of welding is very convenient gives notable effect as	Production of reinforcement and metal products and structures.	

		shouldn't exceed 7 5% of the maximum value of a scale	<p>at the same time it is possible to estimate actual state of process of welding and to take operational measures to elimination of the found defects. At contact welding control of parameters of welding is made by the welder-operator or the available device of control of the modes of welding which a sound signal warns about deviations from the set parameters or automatically interrupts a welding cycle, excepting receiving a low-quality welded seam</p>		
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74	hammer, metal brush, digital tokens, vise, a chisel, a core				Production of reinforcement and metal products and structures	
75	electrode wire Sv-08A diameter of 0.8 ... 1.6 mm				Production of reinforcement and metal products and structures	
76	CO2 gas cylinder				Production of reinforcement and metal products and structures	
77	a low carbon steel plate of a thickness of 8 ... 16 mm,				Production of reinforcement and metal	

					products and structures	
78	fluxes OSC-45, AN-348A				Production of reinforcement and metal products and structures	
79	setting TIG welding MMA-1220				Production of reinforcement and metal products and structures	
80	semiautomatic device for welding in carbon dioxide SAA-120				Production of reinforcement and metal products and structures	
81	welding wire of the				Production of	

	brands Sv-08A and Sv-08G2S with a diameter of 0,8 ... 1,6 mm				reinforcement and metal products and structures	
82	plates from steel and aluminum alloys				Production of reinforcement and metal products and structures	
83	<i>posters</i> – schemes of process and posts of arc welding in protective gases				Production of reinforcement and metal products and structures	
84	spot welding machine MS-602				Production of reinforcement and metal products and	

				structures	
85	spot welding machines ATP-25			Production of reinforcement and metal products and structures	
86	butt welding machine MSS-901			Production of reinforcement and metal products and structures	
87	welding tongs			Production of reinforcement and metal products and structures	
88	cores from low-carbon steel with a			Production of reinforcement	

	diameter of 4... 6 mm and procurements from sheet steel 0,6 thick... 1,2 mm				and metal products and structures	
89	posts for manual arc welding on a direct and alternating current				Production of reinforcement and metal products and structures	
90	inventory copper forms for bathing welding, clips for a fastening of inventory forms				Production of reinforcement and metal products and structures	
91	SAA-162 semiautomatic device				Production of reinforcement and metal	

					products and structures	
92	protective masks with light filters				Production of reinforcement and metal products and structures	
93	electrodes of various brands with a diameter of 3... 5 mm,				Production of reinforcement and metal products and structures	
94	electrode wire with a diameter of 1,2... 2 mm,				Production of reinforcement and metal products and structures	
95	gumboils of the				Production of	

	AH-348A, AH-348AM brands				reinforcement and metal products and structures	
96	procurements from reinforcing steel with a diameter of 20... 40 mm				Production of reinforcement and metal products and structures	
97	posters and pads – welding reinforcing steel in mounting conditions, full-scale samples of bathing welding of vertical and horizontal rods in copper and graphite				Production of reinforcement and metal products and structures	

	forms, on undercoats				
98	post oxyacetylene welding			Production of reinforcement and metal products and structures	
99	burners of different brands			Production of reinforcement and metal products and structures	
100	mandrel			Production of reinforcement and metal products and structures	
101	posters – schemes			Production of	

	of a post of gas welding, devices of acetylene and oxygen cylinders, acetylene generators, gas torches, reducers, a structure of an oxyacetylene flame			reinforcement and metal products and structures	
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10. The list of the recommended literature

1. Name and number of the edition	Author	Publisher, year and place of publication	The module (s), which is used
1	Mikulsky V. G. Gorchakov G. I., etc.	M., ASB, 2000	Laboratory testing for quality control of materials and products Production of concrete mix Production of concrete goods Studying of the main properties of construction materials and designs from them
2	Popov K. N., etc.	M, ASB, 1999 .	Laboratory testing for quality control of materials and products Quality control of concrete goods Production of concrete mix Production of concrete goods Studying of the main properties of construction materials and designs from them
3	Goncharov A.	M, Stroyizdat, 1994	Quality control of reinforcement and metal units and designs

	for the steelfixer-concreter	A., Komova E. A.		<p>Quality control of concrete goods</p> <p>Production of reinforcement units</p> <p>Production of reinforcing and metal designs</p> <p>Production of concrete mix</p> <p>Production of concrete goods</p>
4	Test of construction materials and products	Popov L. I.	M, Vysshaya Shkola, 1987	<p>Laboratory testing for quality control of materials and products</p> <p>Quality control of reinforcement and metal units and designs</p> <p>Quality control of concrete goods</p>
5	Short course of theoretical mechanics	Targ S. M.	M, Science, 1998	<p>Organization of a production process of concrete and metal goods and designs</p> <p>Accomplishment of calculations and designing of steel concrete designs.</p> <p>Accomplishment of calculations and designing of metal designs</p>
6	Resistance of materials	Feodosyev V. I.	M, prod. MSTU, 1999	<p>Organization of a production process of concrete and metal goods and designs</p>

				Accomplishment of calculations and designing of steel concrete designs. Accomplishment of calculations and designing of metal designs
7	Collection of tasks of the materials resistance	Volmir A. S., etc.	M, Nauka, 1984	Organization of a production process of concrete and metal goods and designs Accomplishment of calculations and designing of steel concrete designs. Accomplishment of calculations and designing of metal designs
8	Equipment, mechanization and automation of welding processes	Ovchinnikov V. V.	M, Academy, 2010	Production of reinforcement units Production of reinforcing and metal designs Organization of a production process of concrete and metal goods and designs Automation of production processes of concrete and metal goods and designs

9	Bases of welding production	Vinogradov V. M.	M, Academy, 2008.	Quality control of reinforcement and metal units and designs Production of reinforcement units Production of reinforcing and metal designs
10	Production of welded designs.	Maslov B. G.	M, Academy, 2007.	Quality control of reinforcement and metal units and designs Production of reinforcement units Production of reinforcing and metal designs
11	Production organization.	Fatkhutdinov R. A.	M, INFRA-M, 2001.	Production of reinforcement units Production of reinforcing and metal designs Production of concrete mix Production of concrete goods Organization of a production process of concrete and metal goods and designs Organization, planning and management of the entities of construction products and designs
12	Welded designs. Manufacturing techniques, mechanization,	Kurkin S. L. Nikolaev. L.	M., Vysshaya Shkola, 1991.	Quality control of reinforcement and metal units and designs Production of reinforcement units Production of reinforcing and metal designs Organization of a production process of concrete and metal

	automation and quality control in welding production			goods and designs	
13	Labor protection in construction	Kulikov O.N.	M, Academy, 2003	Implementation of cargo transportation of different types Production of reinforcement units Production of reinforcing and metal designs Production of concrete mix Production of concrete goods	
14	Information technologies Dauletkulov of A.B	Balafons E.K, Buribayev B.,	Almaty, INT, 2009	Organization of a production process of concrete and metal goods and designs Organization, planning and management of the entities of construction products and designs Automation of production processes of concrete and metal goods and designs Standardization organization, certifications and accreditations at the plants of concrete and metal goods	

15	Labor protection in construction	Sukhachyov A. A.	Moscow, KNORUS, 2013.	Implementation of cargo transportation of different types Production of reinforcement units Production of reinforcing and metal designs Production of concrete mix Production of concrete goods Organization of a production process of concrete and metal goods and designs
16	Economy of labor protection	Nurzhasarova M. Ryskulova B., Turgumbayeva H.	Astana, Foliant, 2010.	Organization of a production process of concrete and metal goods and designs Organization, planning and management of the entities of construction products and designs Marketing researches and determination of needs for production of new products. Organization of events on resource-saving in production of construction materials.
17	Technology of construction processes and	Vilman Yu. A.	M, ASB, 2014.	Organization of a production process of concrete and metal goods and designs

	construction of buildings				
18	Design reinforced concrete, stone and armature stone designs	A. K Frolov, A. I Bedov, V. N Shpanova, A. Yu Rodina, T. V Frolova	Associations of construction higher education institutions, 2007.	Organization of a production process of concrete and metal goods and designs Accomplishment of calculations and designing of steel concrete designs. Organization of events on resource-saving in production of construction materials.	
19	Building constructions	Serbin E. P.	Publishing center Academy, 2014.	Studying of the main properties of construction materials and designs from them Organization of a production process of concrete and metal goods and designs Marketing researches and determination of needs for production of new products. Organization of events on resource-saving in production of	

				construction materials.	
20	Project management	Afonin A. M., Tsaregorodtsev Yu. N., Petrov S.A.	FORUM, 2010	<p>Organization of a production process of concrete and metal goods and designs</p> <p>Organization, planning and management of the entities of construction products and designs</p> <p>Standardization organization, certifications and accreditations at the plants of concrete and metal goods</p> <p>Marketing researches and determination of needs for production of new products.</p>	
21	Technical drawing with elements of the programmed training	Vyshnepolsky I. S.	M, Mechanical engineering, 2005.	<p>Organization of a production process of concrete and metal goods and designs</p> <p>Automation of production processes of concrete and metal goods and designs</p> <p>Accomplishment of calculations and designing of steel concrete designs.</p> <p>Accomplishment of calculations and designing of metal designs</p>	
22	Tasks of	Briling N. S.	Proveshenie, 2005.	Organization of a production process of concrete and metal	

	construction and topographical drawing of M,			goods and designs Automation of production processes of concrete and metal goods and designs Accomplishment of calculations and designing of steel concrete designs. Accomplishment of calculations and designing of metal designs
23	Utilization of industrial wastes	Palgunov P. P., Sumarokov M. V.	M, Stroyizdat, 1990	Organization of a production process of concrete and metal goods and designs Organization of events on resource-saving in production of construction materials
24	Technological processes of ecological safety	Rodionov A. I., Klushin V. N., Sister V. G.	Publisher of N.Bochkaryova, Kaluga, 2000.	Organization of a production process of concrete and metal goods and designs Organization of events on resource-saving in production of construction materials
25	Bases of the environmental law	Education guidance	Moscow, Shchit-M, 1999	Standardization organization, certifications and accreditations at the plants of concrete and metal goods Marketing researches and determination of needs for

				production of new products. Organization of events on resource-saving in production of construction materials
26	Bases of ecological insurance	Motkin G. A	Moscow. Science, 1996	Organization, planning and management of the entities of construction products and designs Automation of production processes of concrete and metal goods and designs Standardization organization, certifications and accreditations at the plants of concrete and metal goods Accomplishment of calculations and designing of steel concrete designs. Accomplishment of calculations and designing of metal designs. Marketing researches and determination of needs for production of new products. Organization of events on resource-saving in production of construction materials.
27	Engineering	Brodsky A. M.	M., Academy, 2013	Quality control of reinforcement and metal units and designs

	graphics			Quality control of concrete goods Production of reinforcement units Production of reinforcing and metal designs Production of concrete goods
28	Workshop on engineering graphics	Brodsky A. M..	M., Academy, 2013	Laboratory testing for quality control of materials and products Production of reinforcement units Production of reinforcing and metal designs
29	The collection of exercises for drawings according to engineering graphics	Mironov B.G.	M., Academy, 2013	Implementation of cargo transportation of different types Production of reinforcement units Production of reinforcing and metal designs
30	Metal designs	Belenya E.I.	M., Stroyizdat 1986	Performance of calculations and designing of metal designs
31	Elements of steel	Gorev V. V.,	M., Vysshaya Shkola,	Production of reinforcing and metal designs

	structures	etc.	1997	Organization of a production process of concrete and metal goods and designs Accomplishment of calculations and designing of metal designs
32	Structures of buildings	V. V. Gorev, etc.	M., Vysshaya Shkola, 1999	Implementation of cargo transportation of different types Organization of a production process of concrete and metal goods and designs Accomplishment of calculations and designing of steel concrete designs. Accomplishment of calculations and designing of metal designs
33	Quality control of welded connections: the textbook for SPO	Ovchinnikov V. V.	M, Academy, 2009	Quality control of reinforcement and metal units and designs Production of reinforcement units Production of reinforcing and metal designs.
34	Mechanical properties of metals	Zolotarevsky V. S.	M, Metallurgy, 1983	Quality control of reinforcement and metal units and designs Production of reinforcement units Production of reinforcing and metal designs.

35	Methods of determination of mechanical properties	GOST 6996-66. GOST 6996-66.		<p>Laboratory testing for quality control of materials and products</p> <p>Quality control of concrete goods</p> <p>Production of concrete mix</p> <p>Production of concrete goods</p> <p>Studying of the main properties of construction materials and designs from them</p>
36	Covered electrodes for manual arc welding and surfacing. Classification and general technical conditions	GOST 9466-75		<p>Laboratory testing for quality control of materials and products</p> <p>Quality control of reinforcement and metal units and designs</p>
37	Joints. Methods of quality control	GOST 3242-79		Laboratory testing for quality control of materials and products

					Quality control of reinforcement and metal units and designs
38	Metals. Test methods for bending.	GOST 14019-80			Laboratory testing for quality control of materials and products Quality control of reinforcement and metal units and designs
39	Non-destructive testing. magnetic powder method	GOST 21105-87			Laboratory testing for quality control of materials and products Quality control of reinforcement and metal units and designs
40	Non-destructive testing. Joints. Radiographic method.	GOST 7512-82			Laboratory testing for quality control of materials and products Quality control of reinforcement and metal units and designs

