

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

**NATIONAL TECHNICAL UNIVERSITY
«KHARKIV POLYTECHNIC INSTITUTE»**

APPROVED BY

Rector of NTU "KhPI"

_____ Ye.Sokol

« ____ » _____ 20 ____ .

EDUCATIONALLY - PROFESSIONAL PROGRAM

«ENERGETICS»

The First (Bachelor) Level

by specialty **142 «Power engineering»**

Knowledge field title **14 «Electrical engineering»**

Qualification: **Bachelor of Power Engineering**

APPROVED BY

Academic Council of NTU "KhPI"

Chairman of the Scientific Council

Protocol № _____

« ____ » _____ 20 ____ .

Kharkiv 2019.

APPROVAL PAGE

educationally - professional program «ENERGETICS»

Higher education level	The First (Bachelor) Level
Knowledge field title	14 Electrical engineering
Specialty	142 Power engineering
Specializations	142.01 " Power generation technology and installation "
	142.02 " Computer Engineering of Turbomachines "
	142.04 " Internal combustion engines "
	142.05 " Maintenance, Diagnosis and Repair of Internal Combustion Engines "
	142.06 " Cryogenic and refrigeration engineering "
	142.08 " Thermal Processes in Power Equipment "
Qualification	Bachelor of Power Engineering

APPROVED

Chairman of the support group
for the specialty

Head _____ V.Pylyov

« ____ » _____ 20__.

AGREED

Chairman of the support group
Head of the Department
of Internal combustion engines

_____ V.Pylyov

« ____ » _____ 20__.

AGREED

Head of the Department
of Stim generator

_____ O.Yefimov

« ____ » _____ 20__.

AGREED

Head of the Department of Technical cryophysics

_____ O.Yu.Sipatov

« ____ » _____ 20__.

APPROVED AND PROVIDED

By order of the rector of the National Technical University "Kharkiv Polytechnic Institute"
from « ____ » _____ 20__ . № _____

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RECOMMENDED

Methodical Council of NTU "KhPI"

« ____ » _____ 20__.

AGREED

Head of the Institute of power engineering,
electronics and electromechanics

_____ R.Tomashevskyi

« ____ » _____ 20__.

AGREED

Head of the Department
of Turbine Construction

_____ A.Usaty

« ____ » _____ 20__.

INTRODUCTION

Complies to the Standard of Higher Education of the first (Bachelor) level of the field of knowledge 14 "Electrical Engineering", specialty 142 "Power Engineering", approved and put into effect by order of the Ministry of Education and Science of Ukraine dated 19.10.2018. № 1136.

Developed by the working group on specialty 142 "Power Engineering" of the Institute of Education and Science in Power Engineering, Electronics and Electromechanics of the National Technical University "Kharkiv Polytechnic Institute" consisting of:

- 1 V.Pylyov, D.Sc., professor, Head of the Department of Internal combustion engines.
2. O.Yefimov, D.Sc., professor, Head of the Department of Stim generator.
3. A.Usaty, D.Sc., Senior Scientist, Head of the Department of Turbine Construction.
4. O.Yu.Sipatov, D.Sc., Senior Scientist, Head of the Department of Technical cryophysics.
5. Olga Borisenko, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Steam Generator Department,
5. O.Litvinenko, Candidate of Technical Sciences, Associate Professor, Associate Professor, Department of Turbine Construction.

**1. Profile of the educational program «Energetics»
by specialty 142 «Power engineering»**

1 – General information	
Full name of higher educational institution and structural unit	National Technical University "Kharkiv Polytechnic Institute" Institute of Education and Science in Power Engineering, Electronics and Electromechanics Departments: Stim generator, Turbine Construction, Internal combustion engines, Technical cryophysics
The degree of Higher education and the name of the qualification in the original language title	Ступінь вищої освіти - бакалавр Освітня кваліфікація – бакалавр з енергетичного машинобудування Кваліфікація в дипломі – бакалавр з енергетичного машинобудування
The official name of the educational program	educationally - professional program of The First (Bachelor) Level of the «Energetics» higher educational level.
Type of diploma and volume of educational program	Bachelor's degree, unitary, 240 ECTS credits, term of training 4 years
Availability of accreditation	- Certificate of Accreditation: НД-IV №2158893: - Ministry of education and science of Ukraine; - Validity: until July 1, 2023
Cycle / Level	FQ-EHEA – first cycle, EQF LLL – 6 level, NQF Ukraine – 6 level (Bachelor)
Prerequisites	Complete general secondary education or secondary specialized education By results of external testing The remaining requirements are determined by the rules of admission to the educational and professional program of the bachelor.
Language (s) of teaching	Ukrainian, Russian, English
The validity of the educational program	According to the validity period of the certificate of accreditation
Internet address of the educational program	http://www.kpi.kharkov.ua/ukr/ http://www.kpi.kharkov.ua/rus/faculty/e/
2 – The purpose of the educational program	
<p>The combination of a high level of professional training in the specialty "Power engineering, electrical engineering and electro-mechanics" in the field of electrical engineering with the formation of scientific and technical outlook among specialists and the provision of a broad outlook in the social, humanitarian, fundamental (natural science) and professional fields. The achievement of this purpose is based on the principles of continuity and individualization of training, the fundamental nature and integrity of the knowledge, practical orientation and awareness of the place of the obtained competences, the symbiosis of scientific and systemic approaches.</p> <p>The purpose of the educational program is to train specialists who can count, design, operate, produce, assemble, adjust and repair equipment and introduce energy efficient and energy saving technologies in thermal and nuclear power engineering, industry, transport (ground, sea and river, aviation, special, including armored vehicles), household and agricultural sectors of the economy.</p>	

3 - Characteristics of the educational program	
Subject area (area of knowledge, specialty, specialization)	<p>Knowledge field title: 14 «Electrical engineering» Specialty title: 142 «Power engineering» Specializations: Block 01 "Power generation technology and installation" Block 02 "Computer Engineering of Turbomachines" Block 04 "Internal combustion engines" Block 05 "Maintenance, Diagnosis and Repair of Internal Combustion Engines" Block 06 "Cryogenic and refrigeration engineering" Block 08 "Thermal Processes in Power Equipment"</p>
Orientation of the educational program	<p>Educational and professional program is focused on the formation of the widest possible scientific and technical outlook of the future specialist in specializations, on students achieving knowledge in research, design, construction, operation, installation, repair and modernization of technical means for the production of heat, electricity and chilling, application, management flows and interconversions of other types of energy and heat, process automation; on energy saving, energy efficiency of facilities.</p>
The main focus of the educational program and specialization	<p>General special education and professional training in the field of electrical engineering, the study of the processes occurring in power plants (turbines, boilers, nuclear reactors, pumping equipment, compressors, refrigerating machines and installations, air conditioning systems and life support systems, heat pumps, heat engines, heat exchange and technological devices) with the possibility of acquiring the necessary practical skills for further education or professional career.</p> <p>Keywords: electric power systems and electric technic systems, production of heat, electricity and cold production, fuel and energy sources, heat exchange, heat engineering installations, internal combustion engines, conditioning, heat supply, heating, energy efficiency, energy saving systems, devices and equipment, power stations, energy efficiency and energy saving.</p>
Features of the program	<p>The educational and professional bachelor's program is designed for students who aspire to become specialists in the field of engineering and scientific activity in the energy sector. The main advantage of the bachelor's program is to focus on the formation of the widest scientific and technical outlook of the future professional. The program is balanced in socio-humanitarian and fundamental training and contains sufficient selective component in the specialty. This makes it possible to obtain basic knowledge of fundamental and natural sciences, disciplines of general professional and special training.</p>
4 – Suitability graduates for employment and further education	
Suitability for employment	<p>A graduate can work in positions determined according to the current edition of the National Classifier of Ukraine: Classification of professions (ДК 003: 2010) for the professional training of which educational and professional programs in the specialty "Power Engineering" are directed.</p> <p>A graduate may hold the position of specialist, primary (junior) engineering and management (junior managerial staff) positions: power engineer, power technician (КП code 3113), heat</p>

	<p>engineer, equipment maintenance and repair technician, technologist technician (mechanic), design technician (mechanics), plot mechanic, equipment repair mechanic, refrigerator mechanic, mechanic, diesel and refrigerator mechanic, refrigerator train (section) mechanic (KPI code 3115), commissioning and testing technician, heating technician (KPI code 3119) refrigeration systems mechanic (ship) (KPI code 3141).</p> <p>Subject to the acquisition of industrial experience and passing examinations to confirm the availability of the necessary volumes of professional knowledge and skills, the graduate can work in engineering positions of the relevant departments of the enterprises of the heat power industry and design organizations.</p>
Further education	Continuing education at the second (master's) level of higher education (eighth level of the NQF of Ukraine). The acquisition of additional qualifications in the system of postgraduate education.
5 – Teaching and Assessment	
Teaching and learning	<p>Lectures, practical and laboratory classes, computer workshops; individual classes, consultations, baccalaureate work.</p> <p>The use of blended learning technologies: information and communication, student-centric, modular, practical training technologies, distance learning technologies, self-study.</p>
Assessment	<p>Evaluation of students' educational achievements is carried out according to the ECTS system (with grades A, B, C, D, E, F), the national system (with grades “excellent”, “good”, “satisfactory” and “unsatisfactory”), as well as 100 point system of universities with an established system of compliance.</p> <p><i>Current control</i> - speech and written poll, assessment of work in small groups, testing, defense of group and individual research tasks and projects.</p> <p><i>Final control</i> - speech and written examinations, tests taking into account accumulated points of current control, defense of practice reports, defense of coursework.</p> <p><i>State attestation</i> - preparation and public defense (presentation) of final qualification work.</p>

6 – Program competencies	
Integral competence	<p>The ability to solve complex problems and problems in the field of power engineering or in the learning process involves the use of theories of heat and mass transfer, technical thermodynamics, fluid dynamics, energy transformation, technical mechanics and methods of the relevant sciences and is characterized by complexity and uncertainty of conditions.</p> <p>The ability to solve complex specialized problems and practical problems of heat power engineering in professional activities or in the learning process, involves the use of mathematical theories, methods, algorithms, information technologies and specialized software and is characterized by complexity and uncertainty of conditions.</p>

<p>General competencies (GC)</p>	<p>GC 1. The ability to realize their rights and obligations as a member of society, to realize the values of civil society and the need for its sustainable development, the rule of law, human and citizen rights and freedoms in Ukraine.</p> <p>GC 2. The ability to preserve and enhance moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and the development of society, technic and technology, use various types and forms of physical activity for active recreation and maintaining a healthy lifestyle.</p> <p>GC 3. The ability to apply knowledge in practical situations.</p> <p>GC 4. Knowledge and understanding of the subject area and understanding of professional activity.</p> <p>GC 5. The ability to communicate in the state language both verbally and in writing.</p> <p>GC 6. Ability to use a foreign language in professional activities.</p> <p>GC 7. Skills of using information and communication technologies.</p> <p>GC 8. The ability to learn and master modern knowledge.</p> <p>GC 9. Ability to search, process and analyze information from various sources.</p> <p>GC 10. Ability to work in a team.</p> <p>GC 11. The skills of interpersonal interaction.</p> <p>GC 12. Ability to communicate with representatives of other professional groups of different levels.</p> <p>GC 13. Appreciate and respect diversity and multiculturalism.</p> <p>GC 14. Skills to carry out safe activities.</p> <p>GC 15. The ability to ensure the quality of work.</p> <p>GC 16. The desire to save the environment.</p> <p>GC 17. The ability to act socially responsibly and consciously.</p>
<p>Special (professional, subject) competence (PC) (Determined by the standard of higher education by specialty)</p>	<p>PC-1. Ability to demonstrate a systematic understanding of key aspects and concepts of the development of the power engineering industry.</p> <p>PC-2. The ability to apply their knowledge and understanding to determine, formulate and solve engineering problems.</p> <p>PC-3. The ability to analyze information from literary sources, to carry out a patent search, as well as use databases and other sources of information for professional activities.</p> <p>PC-4. The ability to apply standard methods of calculation in the design of parts and components of energy and process equipment.</p> <p>PC-5. The ability to develop energy-saving technologies and energy-saving measures in the design and operation of energy and heat technology equipment.</p> <p>PC-6. The ability to choose the main and auxiliary materials and methods for implementing the main heat-engineering processes when creating new equipment in the field of power engineering and to apply advanced methods of operating heat-technology equipment for energy facilities, industry and transport, household and agricultural sectors of the economy.</p>

	<p>PC-7. The ability to participate in the development and implementation of heat technology processes in the preparation of the production of new products, check the quality of installation and commissioning during testing and commissioning of new energy facilities and systems.</p> <p>PC-8. The ability to determine the modes of operation of energy and heat technology equipment and apply the methods of rational use of raw materials, energy and other types of resources.</p> <p>PC-9. The ability to perform work on standardization, unification and technical preparation for the certification of technical means, systems, processes, equipment and materials, to organize the metrological support of heat engineering processes using standard methods of product quality control in the field of power engineering.</p> <p>PC-10. Ability to provide modeling of objects and processes using standard and special software packages and automation of engineering calculations, to conduct experiments according to specified methods with processing and analysis of results.</p> <p>PC-11. Ability to use standard methods of planning experimental studies, to process and summarize the results of the experiment.</p> <p>PC-12. Ability to participate in work on innovative projects using research methods.</p>
<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 01 «Power generation technology and installation»</p>	<p>PCS1-1. Ability to perform thermal calculations of power boilers, energy-technological boilers and utilization boilers.</p> <p>PCS1-2. Ability to use knowledge about technologies of production of boilers and reactors.</p> <p>PCS1-3. The ability to apply knowledge of the design of combustion devices of steam boilers at nominal and variable operating modes, the choice of burners.</p>
<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 02 «Computer Engineering of Turbomachines»</p>	<p>PCS2-1. The ability to perform thermal calculations of flowing parts of steam turbines, gas turbines and compressors at calculation and variable operating modes.</p> <p>PCS2-2. The ability to apply knowledge of the design of gas turbine installation schemes and perform circuit calculations for nominal and variable operating modes.</p> <p>PCS2-3. Ability to use knowledge of materials and technologies used in turbine engineering.</p>
<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 04 "Internal combustion engines"</p>	<p>PCS4-1. Ability to use information methods and means for their implementation in solving engineering problems in engine construction.</p> <p>PCS4-2. Ability to use knowledge about the principle of operation of internal combustion engines.</p> <p>PCS4-3. The ability to perform an analysis of dynamic phenomena in internal combustion engines, methods of balancing internal combustion engines and determining the forces acting on structural elements.</p>

<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 05 «Maintenance, Diagnosis and Repair of Internal Combustion Engine»</p>	<p>PCS5-1. Ability to apply knowledge of the features of operation and technologies of maintenance and repair of internal combustion engines.</p> <p>PCS5-2. The ability to perform numerical fuel injection modeling and analysis of fuel injection systems of internal combustion engines.</p> <p>PCS5-3. The ability to apply knowledge about the diagnostic equipment of service centers and technologies for diagnosing internal combustion engines.</p>
<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 06 «Cryogenic and refrigeration engineering»</p>	<p>PCS6-1. Ability to use knowledge of materials and technologies used in cryogenic and refrigeration equipment.</p> <p>PCS6-2. To be able to use methods for obtaining low and ultralow temperatures, properties of superconductivity and superfluidity in experimental and physical research.</p> <p>PCS6-3 Using theory and reference literature, be able to perform calculations of devices and automatic systems for controlling parameters of refrigeration and cryogenic systems.</p>
<p>Professional competencies of specialization (defined by the institution of higher education) (PCS) According to the selective block 08 «Thermal Processes in Power Equipment»</p>	<p>PCS8-1 The ability to use the laws of gas dynamics, hydrodynamics and heat and mass transfer when modeling processes in heat and power equipment.</p> <p>PCS8-2 The ability to use numerical simulation methods for solving problems of hydro and gas dynamics and heat transfer.</p> <p>PCS8-3 The ability to use the laws of thermodynamics in the calculations of thermal power plants.</p>
<p>7 – Program results of training</p>	
<p>Program results of training in the specialty (defined by the standard of higher education by specialty) (PRT)</p>	<p>PRT 1. Knowledge and understanding of mathematics, physics, heat and mass transfer, technical thermodynamics, fluid dynamics, energy transformation, technical mechanics, structural materials, computer-aided design systems for energy machines at the level necessary to achieve the results of the educational program.</p> <p>PRT 2. Knowledge and understanding of engineering at the level required to achieve other results of the educational program, including some awareness of recent achievements.</p> <p>PRT 3. Understanding of the wide interdisciplinary context of the specialty 142 Power engineering.</p> <p>PRT 4. Apply engineering technologies, processes, systems and equipment in accordance with the specialty 142 Power engineering; select and apply suitable typical analytical, computational and experimental methods; correctly interpret the results of such studies.</p> <p>PRT 5. Identify, formulate and solve engineering problems in accordance with the specialty 142 Power engineering; understand the importance of non-technical (society, health and safety, environment, economy and industry) limitations.</p> <p>PRT 6. To develop and design products in the field of power engineering, processes and systems that meet specific require-</p>

	<p>ments, which may include awareness of non-technical (society, health and safety, environment, economy and industry) aspects; election and application of an adequate design methodology.</p> <p>PRT 7. Design power engineering facilities, apply modern commercial and proprietary software products based on an understanding of the industry's advanced achievements.</p> <p>PRT 8. Use scientific databases and other relevant sources of information, carry out modeling in order to study in detail and study engineering issues in at least one of the areas of power engineering.</p> <p>PRT 9. Apply regulatory documents and safety regulations when solving professional tasks.</p> <p>PRT 10. To plan and carry out experimental studies with the help of tools (measuring instruments), to estimate the errors of research, to draw conclusions.</p> <p>PRT 11. Understanding of the applied methods of design and research in the field of power engineering, and their limitations.</p> <p>PRT 12. Apply practical skills to solve problems involving the implementation of engineering projects and research.</p> <p>PRT 13. Use equipment, materials and tools, engineering technologies and processes, as well as an understanding of their limitations in solving professional problems.</p> <p>PRT 14. Apply engineering practices in the field of power engineering.</p> <p>PRT 15. Understanding the non-technical (society, health and safety, environment, economy and industry) implications of engineering practice.</p> <p>PRT 16. Obtain and interpret relevant data and analyze difficulties in the field of power engineering to deliver judgments that reflect relevant social and ethical issues.</p> <p>PRT 17. To manage professional activities in the work on projects in at least one of the areas of power engineering, taking responsibility for making decisions.</p> <p>PRT 18. Communicate effectively about information, ideas, problems and solutions with the engineering community and society as a whole.</p> <p>PRT 19. Work effectively in a national and international context, as an individual and as a member of a team, and collaborate effectively with engineers and non-engineers.</p> <p>PRT 20. Understanding the need for independent learning throughout life.</p> <p>PRT 21. Analyze the development of science and technology.</p>
<p>Program results of training in a specialty (defined by the institution of higher education) (PRTS)</p> <p>By selective blocks:</p> <p>01 «Power generation technology and installation»</p> <p>02 «Computer Engineer-</p>	<p>PRTS 1. Understanding of the applied methods of design and research, as well as their limitations according to the specializations of the specialty 142 - Power engineering.</p> <p>PRTS 2. Knowledge and understanding of the engineering issues that underlie the specializations of the specialty 142 - Power engineering at the level necessary to achieve other results of the educational program, including some awareness in the latest achievements of science and technology.</p> <p>PRTS 3. Practical skills of solving problems, providing for the implementation of engineering projects and conducting research</p>

<p>ing of Turbomachines» 04 «Internal combustion engines» 05 «Maintenance, Diagnosis and Repair of Internal Combustion Engines» 06 «Cryogenic and refrigeration engineering» 08 «Thermal Processes in Power Equipment»</p>	<p>in accordance with the specializations of specialty 142 - Power engineering. PRTS 4. The ability to manage professional activities, to participate in the work on projects in accordance with the specializations of specialty 142 - Power Engineering. PRTS 5. Ability to apply the norms of engineering practice in accordance with the specializations of specialty 142 - Power Engineering.</p>
8 – Resource support for the implementation of the program	
Staffing	Corresponds to personnel requirements to ensure the implementation of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On Approval of Licensing Conditions for Educational Activities of Educational Institutions" No. 1187 of December 30, 2015 (as amended by Resolution of the Cabinet of Ministers No. 347 dated 05/10/2018).
Material and technical support	Complies with the technological requirements for the material and technical support of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for the implementation of educational activities of educational institutions" of December 30, 2015, No. 1187 (as amended according to Resolution of the Cabinet of Ministers № 347 from 10.05.2018).
Information and educational support	Corresponds to the technological requirements of educational and methodological and informational support of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On Approving Licensing Conditions for Educational Activities of Educational Institutions" dated December 30, 2015 No. 1187 (as amended Resolution of the Cabinet of Ministers № 347 from 10.05.2018).
9 – Academic mobility	
National Credit Mobility	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and higher educational institutions of Ukraine
International Credit Mobility	On the basis of bilateral agreements between the National Technical University "KPI" and educational institutions of the partner countries.
Training foreign applicants for higher education	Occurs with the parallel teaching of the course of Ukrainian as a foreign language on a separate curriculum.

2. LIST OF EDUCATIONAL PROGRAM COMPONENTS

2.1 List of educational program components

Key	Educational program components (disciplines, projects / work, practice, qualification work)	Credits ECTS	Form of final control
1	2	3	4
REQUIRED COMPONENTS OF THE EDUCATIONAL PROGRAM (applicants for education - citizens of Ukraine)			
1. Required components of the educational program			
<i>General training</i>			
GT1	History and Culture of Ukraine	4	Exam
GT2	Ukrainian language	3	Exam
GT3	Foreign language	12	Test (1,2,7,8), Exam (3)
GT4	Higher Mathematics	19	Exam
GT5	Physics	13	Exam
GT6	General Chemistry	4	Test
GT7	Ecology	3	Test
GT8	Jurisprudence	3	Test
GT9	Philosophy	3	Exam
GT	Physical Education	12	Test (1-6)
<i>Professional training</i>			
PT 1	Descriptive Geometry, Engineering and Computer Graphics	6	Exam (1) Test (2)
PT 2	Theoretical Mechanics	5	Exam
PT 3	Hydro-Gas Dynamics	4	Test
PT 4	Materials Science and Technology of Construction Materials	3	Exam
PT 5	Strength of Materials	5	Exam
PT 6	Electrical Engineering and Electronics	5	Exam
PT 7	Metrology and Standardization	3	Test
PT 8	History of science and technology	3	Test
PT 9	Fundamentals of Design	4	Exam
PT 10	Business Economics	3	Test
PT 11	Fundamentals of occupational safety and health	3	Exam
PT 12	Practice	6	Test
PT 13	Attestation (Diploma project)	6	Test
Total volume of Required components		132	

Required components of the educational program (applicants for education are foreigners)			
<i>General training</i>			
GT 1	History and Culture of Ukraine	4,0	Exam
GT 2	Language as a medium of training	10,0	Test (1) Exam (2)
GT 3	Ukrainian as a foreign language	9,0	Test (3,4) Exam (5)
GT 4	Foreign language	8,0	Test (2,7,8) Exam (3)

GT 5	Higher Mathematics	190	Exam (1,2,3,4)
GT 6	Physics	13,0	Exam (1,2,3)
GT 7	General Chemistry	4,0	Test
GT	Physical Education	12,0	Test (1-6)
<i>Professional training</i>			
PT 1	Descriptive Geometry, Engineering and Computer Graphics	6,0	Exam (1) Test (2)
PT 2	Theoretical Mechanics	5,0	Exam
PT 3	Hydro-Gas Dynamics	4,0	Test
PT 4	Materials Science and Technology of Construction Materials	3,0	Exam
PT 5	Strength of Materials	5,0	Exam
PT 6	Electrical Engineering and Electronics	5,0	Exam
PT 7	Metrology and Standardization	3,0	Test
PT 8	Fundamentals of Design	4,0	Exam
PT 9	Business Economics	3,0	Test
PT 10	Fundamentals of occupational safety and health	3,0	Exam
PT	Practice	6	Test
PT	Attestation (Diploma project)	6	Test
Total volume of Required components		132	

**2. Optional disciplines of the educational program
(applicants for education are citizens of Ukraine and foreigners)**

Discipline block 01 "Power generation technology and installation"

OB 1.1	Introduction to Specialty	3,0	Test
OB 1.2	Software Engineering in Power industry	11,0	Exam
OB 1.3	Computer science in Power engineering	4,0	Test
OB 1.4	Heat Engineering Measures and Devices	6,0	Test
OB 1.5	Technical Thermodynamics	8	Test (4), Exam (5)
OB 1.6	Thermal and Nuclear Power Plants	4,0	Exam
OB 1.7	Computer Aided Design Software	4,0	Exam
OB 1.8	Heat Mass Exchange	10,0	Exam
OB 1.9	Mathematic Methods and Models of Energy Equipment in Computer Calculations	4,0	Exam
OB 1.10	Furnace Processes and Devices	8,0	Exam
OB 1.11	Water Treatment and Water Treatment of Boiler Installa- tions	4,0	Exam
OB 1.12	Thermo-hydraulic processes in boilers and reactors	4,0	Exam
OB 1.13	Steam and Gas Turbines	3,0	Test
OB 1.14	Production technology of boilers and reactors	3,0	Test
OB 1.15	Fundamentals of Boiler Constructing	8,0	Exam
OB 1.16	Automation of technological processes of Power facilities	4,0	Exam
OB 1.17	Reactors and Steam Generators of Nuclear Power Stations	4,0	Exam
OB 1.18	Mathematical foundations of automated design systems	4,0	Exam
	Total:	96	

Discipline block 02 "Computer Engineering of Turbomachines"

OB 2.1	Introduction to Specialty	3,0	Test
OB 2.2	Fundamentals of Programming of Engineering Problems in the Energetics	10,0	Exam
OB 2.3	Computer Technologies in Design	6,0	Test

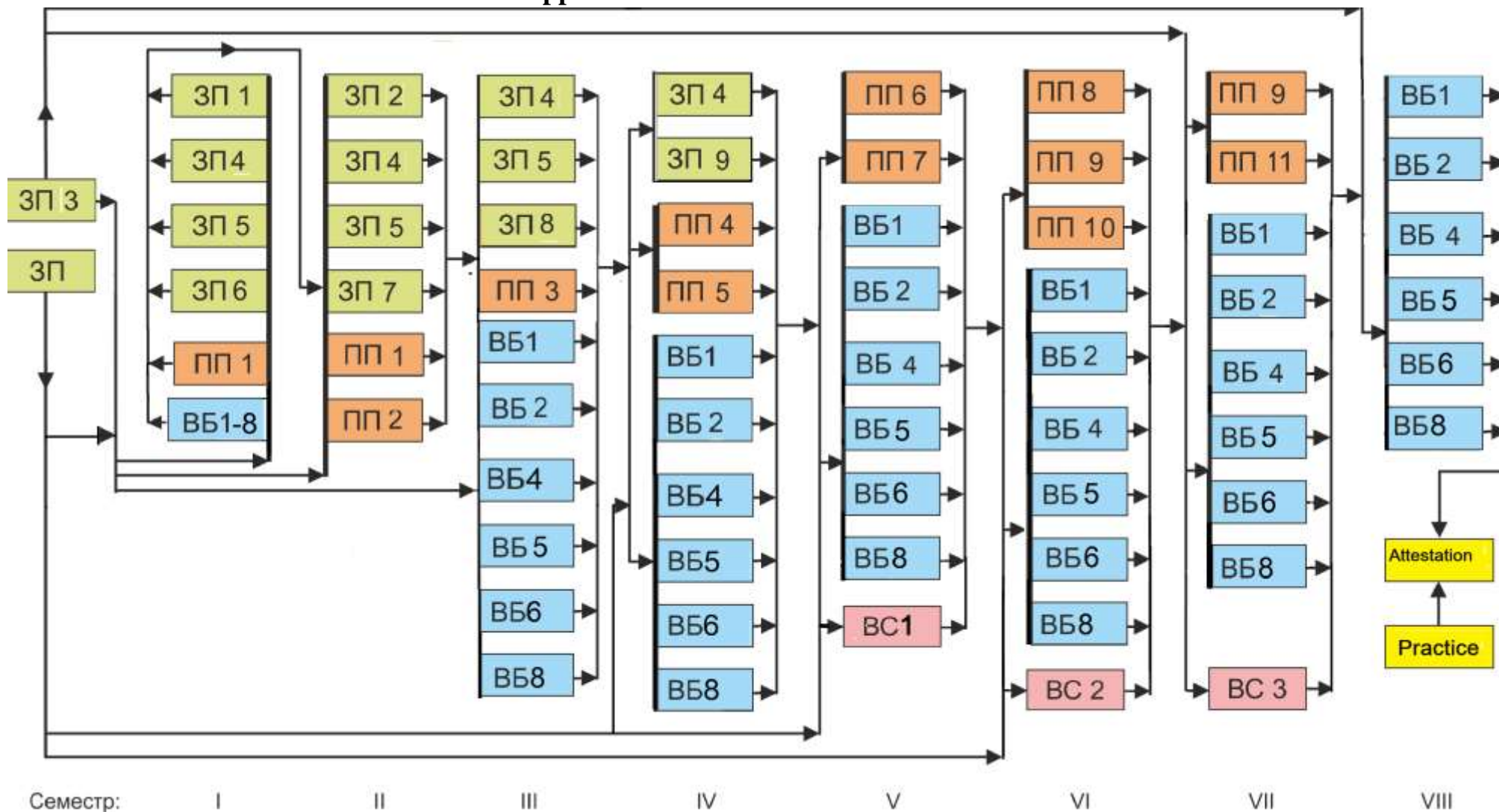
OB 2.4	Technical Thermodynamics	8,0	Test (4) Exam (5)
OB 2.5	Heat Mass Exchange	9,0	Exam
OB 2.6	Heat Engineering Measures and Devices	4,0	Test
OB 2.7	Gas Dynamics of Turbomachinery	11,0	Exam
OB 2.8	Thermal Calculations in Turbomachines	9,0	Exam
OB 2.9	Gas-turbine Installations	4,0	Exam
OB 2.10	Strength Calculations of Turbomachinery Components	4,0	Exam
OB 2.11	Theory of Compressors	5,0	Exam
OB 2.12	Variable Modes of Gas-turbine Installations	3,0	Test
OB 2.13	Thermal and Nuclear Power Plants	4,0	Exam
OB 2.14	Constructions of Steam and Gas Turbines	5,0	Exam
OB 2.15	Computer Modeling of Thermal Schemes of Turbines (AxCYCLED)	4,0	Test
OB 2.16	Variable Steam Turbine Modes	3,0	Test
OB 2.17	Technology of Turbine Construction	4,0	Exam
	Total:	96	
Discipline block 04 "Internal combustion engines"			
OB 4.1	Introduction to Specialty	3,0	Test
OB 4.2	Information Technology and programming in the Internal Combustion Engines	11,0	Exam
OB 4.3	Thermodynamics of heat engines	6,0	Exam
OB 4.4	Chemotology and alternative fuels	4,0	Test
OB 4.5	Constructions of Internal Combustion Engines	9,0	Exam
OB 4.6	Theory of Internal Combustion Engines	11,0	Exam
OB 4.7	Fundamentals of heat transfer in internal combustion engines	3,0	Exam
OB 4.8	Fundamentals of Computer-aided Design Systems (CAD) of Internal Combustion Engines	8,0	Test
OB 4.9	Units with Internal Combustion Engines	4,0	Test
OB 4.10	Fuel Systems of Internal Combustion Engines	5,0	Exam
OB 4.11	Supercharging and Heat recovery Systems of Internal combustion engines	4,0	Exam
OB 4.12	Electronic control and diagnostic systems of Internal Combustion Engines	4,0	Test
OB 4.13	Maintenance, service and Repair of Internal Combustion Engines	4,0	Exam
OB 4.14	Dynamics of Internal Combustion Engines	4,0	Exam
OB 4.15	Systems of Automatic Control of Internal Combustion Engines	4,0	Exam
OB 4.16	Testing of Internal Combustion Engines	4,0	Exam
OB 4.17	Perspective Power Plants With Internal Combustion Engines and Tuning	4,0	Exam
OB 4.18	Production Technology of Internal Combustion Engines	4,0	Exam
	Total:	96	
Discipline block 05 "Maintenance, Diagnosis and Repair of Internal Combustion Engines"			
OB 5.1	Introduction to Specialty	3,0	Test
OB 5.2	Information Technology and programming in the Internal Combustion Engines	11,0	Exam
OB 5.3	Thermodynamics of Heat Engines	6,0	Exam
OB 5.4	Chemotology and alternative fuels	4,0	Test
OB 5.5	Constructions of Internal Combustion Engines	9,0	Exam
OB 5.6	Theory of Internal Combustion Engines	11,0	Exam

OB 5.7	Fundamentals of heat transfer in internal combustion engines	3,0	Exam
OB 5.8	Fundamentals of Computer-aided Design Systems (CAD) of Internal Combustion Engines	8,0	Test
OB 5.9	Units with Internal Combustion Engines	4,0	Test
OB 5.10	Fuel Systems of Internal Combustion Engines	5,0	Exam
OB 5.11	Supercharging and Heat recovery Systems of Internal combustion engines	4,0	Exam
OB 5.12	Electronic Control and Diagnostic systems of Internal Combustion Engines	4,0	Exam
OB 5.13	Diagnostic Equipment and Diagnostics of Internal Combustion Engines	4,0	Exam
OB 5.14	Dynamics of Internal Combustion Engines	4,0	Exam
OB 5.15	Automatic Control Systems of of Internal Combustion Engines	4,0	Exam
OB 5.16	Testing of Internal Combustion Engines	4,0	Exam
OB 5.17	Technology of Internal Combustion Engine Repair	4,0	Exam
OB 5.18	Organization of Service and Repair of Internal Combustion Engines	4,0	Exam
	Total:	96	
Discipline block 06 "Cryogenic and refrigeration engineering"			
OB 6.1	Introduction to Specialty	3,0	Test
OB 6.2	Information technology in cryogenic and refrigeration engineering	11,0	Exam (3) Test (4)
OB 6.3	Technical thermodynamics at low temperatures	6,0	Test
OB 6.4	Physical bases of vacuum technology	4,0	Test
OB 6.5	Heat and mass transfer	5,0	Exam
OB 6.6	Mathematical methods and models of power equipment in the calculations on a computer	4,0	Exam
OB 6.7	Special issues of heat and mass transfer	6,0	Exam
OB 6.8	Compressor machines	6,0	Exam
OB 6.9	Physical Principles of Micro- and Nanotechnologies	5,0	Exam
OB 6.10	Thermotechnical measurements and devices	5,0	Exam
OB 6.11	Air conditioning systems	4,0	Exam
OB 6.12	Theoretical foundations of refrigeration and cryogenic engineering	4,0	Exam
OB 6.13	Extensible machines and devices	6,0	Exam
OB 6.14	Fundamentals of digital and microprocessor technology	6,0	Exam
OB 6.15	Devices and automation of refrigerating and cryogenic systems	5,0	Exam
OB 6.16	Research Methods in low-temperature engineering	4,0	Exam
OB 6.17	Cryogenic systems of liquefaction and separation of gas mixtures	4,0	Exam
OB 6.18	Installation, operation and service of refrigeration units	4,0	Exam
OB 6.19	Design of heat exchangers	4,0	Exam
	Total:	96	
Discipline block 08 "Thermal Processes in Power Equipment"			
OB 8.1	Introduction to Specialty	3,0	Test
OB 8.2	Fundamentals of Programming of Engineering Problems in the Energetics	10,0	Exam
OB 8.3	Computer Technologies in Design	6,0	Test
OB 8.4	Technical Thermodynamics	8,0	Test (4)

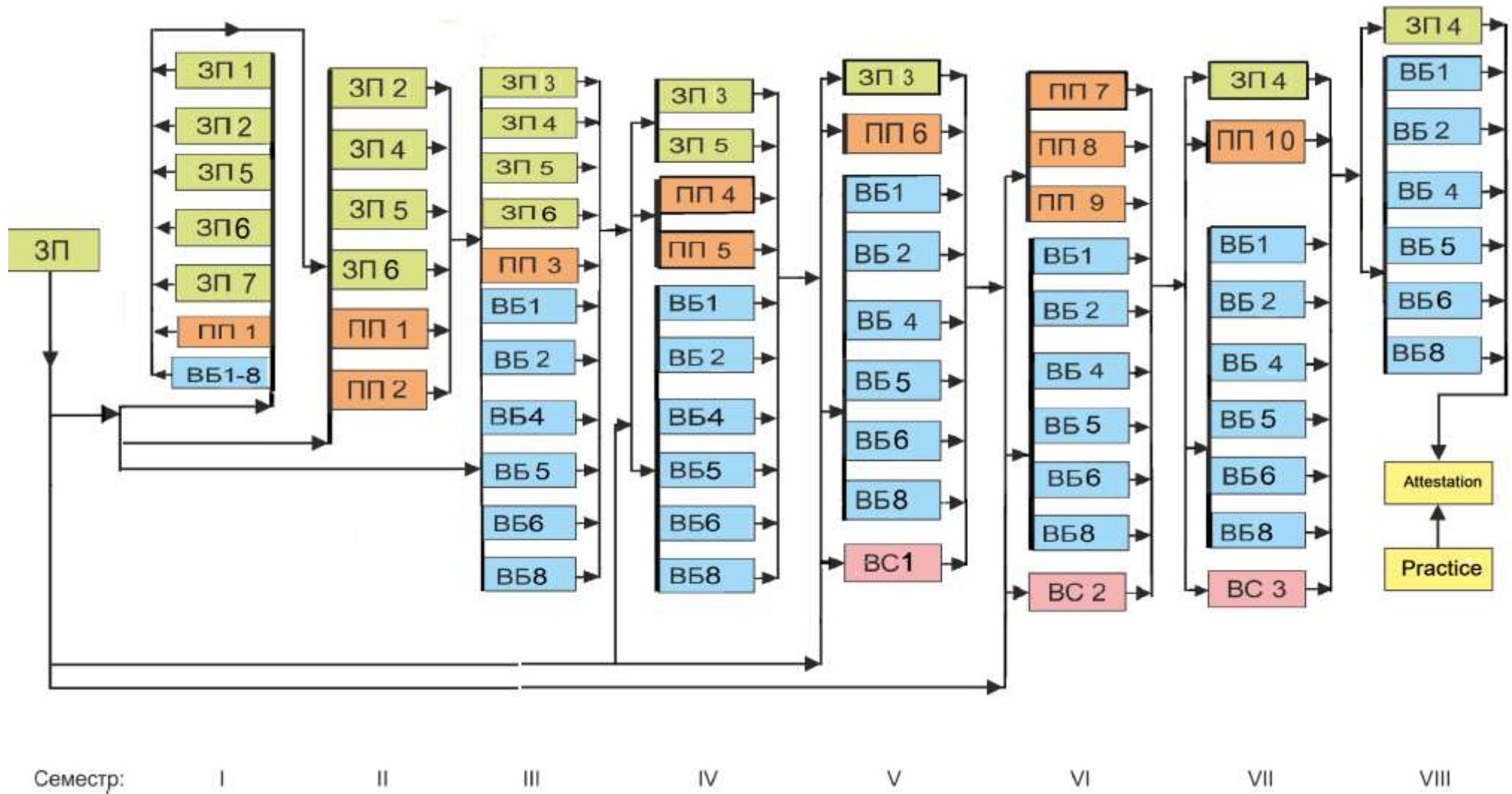
			Exam (5)
OB 8.5	Heat Mass Exchange	9,0	Exam
OB 8.6	Heat Engineering Measures and Devices	4,0	Test
OB 8.7	Gas Dynamics of Turbomachinery	11,0	Exam
OB 8.8	Thermal Calculations in Turbomachines	9,0	Exam
OB 8.9	Gas-turbine Installations	4,0	Exam
OB 8.10	Research Methods of Heat Transfer Processes	3,0	Test
OB 8.11	Construction and Strength of Turbomachinery	4,0	Exam
OB 8.12	Heat and Mass Transfer Processes, Equipment and Installations	9,0	Exam
OB 8.13	Thermal and Nuclear Power Plants	4,0	Exam
OB 8.14	Computer Modeling of Thermal Schemes of Turbines (AxCYCLED)	4,0	Test
OB 8.15	Fire Engineering Installations and Processes	5,0	Exam
OB 8.16	Variable Steam Turbine Modes	3,0	Test
	Total:	96	
Student optional disciplines			
Student optional disciplines			
OS 1	Optional discipline 1	4	Test
OS 2	Optional discipline 2	4	Test
OS 3	Optional discipline 3	4	Test
	Total:	12	
Total amount of sample components:		108	
TOTAL VOLUME OF EDUCATIONAL PROGRAM		240	

2.2 Structural-logical scheme of the educational program

2.2.1 Applicants for education - citizens of Ukraine



2.2.2 Applicants for education are foreigners



2.3 Distribution of the content of the educational program into groups of components and training cycles

№	Training cycle	Volume of study load of the applicant of higher education (ECTS credits /%)		
		Required components of the educational and professional program	Optional components of the educational-professional program	Total for the whole period of study
1	General training	76 / 32	-	76 / 32
2	Professional training	56 / 23	-	56 / 23
3	Optional disciplines	-	108 / 45	108 / 45
Total for the whole period of study		132 / 55	108 / 45	240 / 100

3. Form of certification of applicants for higher education

Certification of graduates of the educational program of **specialty 142 "Power Engineering"** is carried out in the form of defense of qualification work and ends with the issuance of a standard document on awarding a bachelor's degree with conferring the qualification "**Bachelor of Power Engineering**" in the relevant specializations.

The certification is carried out openly and publicly.

Final qualifying work is being tested for plagiarism.

