Ministry of Education and Science of Ukraine

NATIONAL TECHNICAL UNIVERSITY

"KHARKIV POLYTECHNIC INSTITUTE"

APPROVED

Acting rector of NTU "KhPI"

_____ Andrei MARCHENKO

«09» липня 2020

EDUCATIONAL-PROFESSIONAL PROGRAM

OIL AND GAS PRODUCTION

The first (bachelor) level

Specialty	**185 Oil and Gas Engineering and Technology**
Field of knowledge	**18 Production and Technology**
Qualification	**Bachelor of Oil and Gas Engineering and Technology**

APPROVED

SCIENTIFIC COUNCIL of NT "KhPI"

Chairman of the Scientific Council

Protocol No 4

July 3, 2020

Kharkiv

2020

LETTER OF APPROVAL

Educational and professional program

University-level education — First (Bachelor)

Field of knowledge — 18 Production and Technology

Specialty — 185 Oil and Gas Engineering and Technology

Qualification — Bachelor of Oil and Gas Engineering and Technology

DEVELOPED

By Project team

Specialty

"Oil, Gas and Condensate Production"

Head of educational program

"Oil and Gas Production"

_____I.M. Fyk

June 22, 2020

AGREED

Head of the Department

"Oil, Gas and Condensate Production"

_____I.M. Fyk

June 22, 2020.

AGREED

Director of Educational and Scientific

Institute of Chemical Technology and Engineering

_____I.M. Ryschenko

July 1, 2020.

AGREED

Ukrainian Scientific

and Research Institute of Natural Gases

Director

_____S.V. Kryvulia

June 25, 2020.

AGREED

Private joint stock company

"Ukrgazvidobutok"

Director

_____V.P. Makhnovets

June 25, 2020.

Head of Student Council,
Student, group I-319 c
_____ Birukova Diana
June 30, 2020.

INTRODUCTION

Educational and professional program for Bachelor's training on Specialty 185 "Oil and Gas Extraction" is a provisional regulatory document drawn up in accordance with the requirements of the National Qualifications Framework of Ukraine.

Head of the project team (guarantor of the educational program) - Fyk Ilya Mykhailovich, Doctor of Engineering Sciences, Professor, Head of the Department "Oil, Gas and Condensate Extraction
"

Project team members:

1.Biletskyi Volodymyr Stefanovych, Doctor of Engineering Sciences, Professor, Professor at the Department "Oil, Gas and Condensate Extraction"

2. Rimchuk Danilo, Candidate of Engineering Science, Associate Professor at the department "Oil, gas and condensate extraction".

External stakeholder reviews:

1. Oleksiy Mykolajovych Karpenko, Doctor of Geological Sciences, Professor, Head of the Department "Oil and Gas Geology", at Kyiv National University by Taras Shevchenko;
2. Deputy Director for Scientific Work at Scientific Research Institute of Gas Transport Candidate of Science (Engineering) Yuriy Volodymyrovych Ponomarev.

From employers:

1. Director of the Ukrainian Scientific and Research Institute of Natural Gases Candidate of Geological Sciences Serhiy Viktorovych. Kryvulia;
2. Chief engineer of GPD "Shebelinkagazvidobuvannya" Andriy Petrovich Vakhriv;
3. Director of Private Joint Stock Company "Ukrgasvydobutok" Volodymyr Petrovych Makhovets;

From the graduates of the program:

1. Head of the Authorial Supervision sector over the development of deposits at the department of development gas and condensate fields, UkrNRIgaz Karina Yuriivna Skrylnyk.

CONTENT

1. PROFILE OF THE EDUCATIONAL-PROFESSIONAL PROGRAM

Oil and Gas Extraction
specialty 185 Oil and gas engineering and technology

1 – General information	
Full name institute/faculty/department/	National Technical University "Kharkiv Polytechnic Institute", Educational and Scientific Instltute of Chemical Technologies and Engineering, Department of Oil, gas and condensate production
Higher Education Degree and original name of qualification	Higher Education Degree - Bachelor Qualification – Bachelor of oil and gas engineering and technology
Official name of educational program	Oil and gas production
Type of diploma and content of educational program	Single, 240 ECTS credits, term of study – 4 years
Accreditation	Primary
Program cycle / level	FQ-EHEA – 1st cycle QF LLL –degree 6, HPK Ukraine – qualification degree 6
Initial conditions	Complete general secondary or vocational education
The language of instruction	Ukrainian/English
Validity period of the educational program	Accordance to the validity period of a certification about accreditation
Internet constant address of the education al program	http://web.kpi.kharkov.ua/dngik/wp-login.php
2 – Educational program goals	
To provide up-to-date, high-quality training for specialists in the development of oil and gas fields, development and adoption of technologies for well drilling, extraction, transportation, industrial collection, preparation of hydrocarbons and storage of oil, gas and petroleum products, taking into account the needs of all stakeholders.	
3 – Feature of the educational program	
Subject area (branch of knowledge, specialty, program)	Branch of knowledge: 18 Production and technology Specialty: 185 Oil and Gas Engineering and Technology Educational—professional program: Oil and Gas Production
Orientation of the educational program	Applied orientation The program focuses on training professionals to gain professional knowledge in the development of oil and gas fields, oil and gas production, which provides employment and opportunities for further education and career,

The main focus of educational program and specialization	Special education in production and technology Specialty - Oil and gas engineering and technology Key words: oil, gas, production, development, gas deposits, drilling, transportation, storage, technology, well, well operation, geology, research and workover.
Description of the program	The special feature of the program is the acquisition of knowledge in the development field with up-to-date technologies, geophysical exploration of wells, wells drilling, oil and gas production, transportation and storage of hydrocarbons. The emphasis of the educational and professional program is on the disciplines of technical and technological operation of the objects in oil and gas industry with elements of innovation and modern engineering, elements of blogging, 3D-visualization, group educational VEB-chats are applied. Assimilation of software complexes makes it possible to be competitive in the labor market in Ukraine and abroad
4 – Graduates' eligibility for employment and further education	
Employment eligibility	The graduate may hold the following primary positions in accordance with the Reference Book of Qualifications of Workers' Occupations (SC 003: 2010): 3117 oil and gas production technicians; 3117 drilling technicians; 3117 oil and gas preparation and transportation technicians; 3117 oil pipeline technicians; 3117 technicians operating gas facilities equipment; 1222.2 Oil, Gas, and Condensate production foreman; 1222.2 well survey foreman; 1222.2 well development and workover of injection wells foreman; 1222.2 gas preparation foreman; oil preparation and stabilization foreman; 1222.2 well-craftsman in well drilling; 1222.2 workover operation foreman (capital, underground); 1222.2 tank farm foreman; 1222.2 foreman driller; 1222.2 foreman driller for deep (structural-reconnaissance) drilling; 1222.2 well test foreman; 1222.2 operation of gas facilities equipment foreman.

Further study	Ability to continue education at the second (master's) level of higher education, obtaining postgraduate education with related specialties at higher education institutions in Ukraine and abroad.
5 – Teaching and grading	
Teaching and learning	**Problem- and practically-based learning**, with the principles of student-centrism and individual-personal approach. **Teaching** is carried out through lectures, seminars, practical and laboratory classes, organization of independent students` work, trainings for the development of creative thinking and ability to work in a team, training and production practice in research institutes and fields GPD "Shebelinkagazvidobuvannya," scientific research directing. **Learning** is provided by attending lectures, seminars, practical and laboratory classes, working with educational and scientific sources in the library, carrying out scientific research, developing skills and practices during practice, creating presentations.
Assessment	Students' knowledge and skills are monitored in the form of a current and final control *Current control* - oral and written questioning, assessment of a work in small groups, testing, individual tasks defense, a course work (projects) defense, reports of training and production practice defense. *Final control* is carried out in the form of examinations, tests and certification in the form of passing a qualification exam.
6 – Program competencies	
Integral competence	Ability to solve complex specialized challenges and practical problems in the professional activities related to the oil and gas industry, or in the process of training, which involves the application of certain theories and methods of oil and gas mechanics and it is characterized by complexity and uncertainty of the conditions.
General Competences (GC)	
GC1	Ability to abstract thinking, analysis and synthesis.
GC2	Knowledge and understanding of subject scope and understanding of professional activities
GC3	Ability to communicate in native language both verbally and in writing in career
GC4	Ability to communicate in a foreign language in career
GC5	The ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary for the digestion of special subjects.
GC6	The ability to store and increase moral, cultural, scientific values, the achievement of society based on an understanding of the history and laws of the development of the oil and gas industry, its place in the general system of knowledge about nature and society and in the development of society.
GC7	Ability to acquirement a system of philosophical knowledge that serves as methodological tools for the analysis of natural, technical and humanitarian theoretical and practical problems, the formation of high moral moralities and behaviors that are based on universal human values, self-comprehension and a sense of responsibility for the future of state.
GC8	Safety skills taking into account environmental requirements.

GC 9	Ability to realize rights and duties as a member of society, to understand the values of public society and the need for its sustainable development, the rule of law and political freedoms of human and citizens of the state
Professional competences (PC)	
PC 1	Ability to characterize geological processes and patterns of rocks formation, including oil and gas deposits, ability to make structural maps, isobar maps, geological and geophysical profiles.
PC 2	Ability to spatial thinking, analysis and synthesis of geometric information, to use geometric data and computer graphics in engineering activities
PC 3	Ability to apply new advances in physics and chemistry to analyze the physical and chemical properties of hydrocarbons in the implementation of advanced technologies for wells drilling, production, transportation and storage of oil, gas and petroleum products, including at a later stage of operation.
PC 4	Ability to apply new advances in thermodynamics, hydraulics, and gas dynamics to analyze oil and gas movement processes in reservoirs, wells, industrial and trunk pipelines using 3-D simulation.
PC 5	Ability to apply mathematical methods to analyze technological processes of well drilling, production, primary processing, transportation and storage of oil and gas, including modern software products.
PC 6	Ability to use software for predictive operational calculations of technological parameters of wells drilling, production, primary processing, transportation and storage of oil and gas.
PC 7	Ability to apply the fundamentals of materials science, machine mechanics to assess the technical state of the elements of technological equipment for wells drilling, production, primary processing, transportation and storage of oil and gas
PC 8	Ability to apply basic methods of analysis and assessment of the elements state for oil and gas systems by means of technical diagnostics in industrial and laboratory conditions
PC 9	Understanding the general principles of control methods choice and automation of technological processes in the oil and gas industry
PC 10	Ability to analyze operating modes of oil and gas facility, make optimal selection for technological equipment, to perform optimization of operating mode by a certain criterion
PC 11	Ability to carry out technological, technical and economic evaluation of the effective use of basic oil and gas technologies and technical devices, equipment, systems
PC 12	Ability to plan and organize the work of the structural unit in the oil and gas company in accordance with the requirements of life and work safety on the base of legal regulations.
PC 13	Ability to apply engineering methods in the optimization and rational development of oil, gas and gas condensate fields
7 – Program learning outcomes	
	To demonstrate a deep understanding of the current state and the role of the oil and gas industry, professional activity in ensuring energy security in Ukraine.

PLO 1	Be able to create projection models of geometric objects, generate drawings, solve positional and metric tasks, graphically depict engineering objects during their modeling and design.
	To demonstrate the knowledge of technical terminology, the ability to express your thoughts logically in the official language, both orally and in writing
PLO 2	Know technical terminology, be able to logically express thoughts both orally and in writing.
PLO 3	Know the basics of geology and geodesy regarding the processes of drilling, production, collection, preparation, transportation and storage of oil and gas
PLO 4	Use the information technology to solve tasks and problems regarding the processes of oil and gas production, including knowledge of industrial-geophysical and hydrodynamic studies of reservoirs and wells.
PLO 5	To know the basic laws of physics and chemistry for forecasting and analysis of physical and chemical properties of oil, condensate and natural gas in the processes of their wells drilling, production, primary processing, transportation and storage of the hydrocarbons.
PLO 6	To know the mathematical methods for determining the specific values of technological parameters for reservoir systems of oil and gas wells, oil and gas preparation systems, industrial and main gas and oil pipelines, gas and oil storage reservoirs.
PLO 7	Be able use the modern software programs for design and operational calculations for technological processes parameters of well drilling, production, transportation and storage of oil and gas.
PLO 8	To know and analyze the technical component state of the technological equipment in the systems of well drilling, production, transportation and storage of oil and gas using methods based on materials science and machinery mechanics, electronics and electrical equipment basics.
PLO 9	To know, set and analyze operating modes in the gas object components, to make the optimal choice of technological equipment, to perform the operating mode optimization according to a certain criterion
PLO 10	To know the general principles for control means choice and automation of technological processes in the oil and gas industry
PLO 11	Be able to think abstractly, carry out an analysis in the development of technological and accounting schemes for technical systems elements.
PLO 12	Be able to communicate in a foreign language, including the basic knowledge of special terminology and skills working with foreign technical publications
PLO 13	Be able to apply information and communication technologies to solve a specific engineering problem.
PLO 14	Be able to search and analyze scientific and technical literature on a paper and an electronic media.
PLO 15	To demonstrate the ability to work in a team when performing laboratory work, developing complex course projects, preparing presentations, etc.
PLO 16	Be able to carry out safe and ecological operations at oil and gas facilities
PLO 17	Be able to calculate the parameters of hydro-gas dynamic processes that accompany the movement of oil and gas in the reservoir / wells / industrial and main pipelines, technological equipment, taking into account the basic laws of thermodynamics, hydraulics and gas dynamics.

PLO 18	Be able to apply the basic methods of analysis and evaluation of the component state in the oil and gas objects by means of technical diagnostics in industrial and laboratory conditions
PLO 19	Be able to evaluate the efficient use of basic oil and gas technologies and technical devices using the technical and economic criteria.
PLO 20	Be able to plan or organize the work of the structural unit in the oil and gas company in accordance with the requirements of life safety, work safety, environmental protection and legal documents.
PLO 21	Be able to evaluate the development efficiency with hydrocarbon production prospects
PLO 22	To understand the possibility of restoring reserves of oil and gas fields under development and the use of oil and gas wells as a means of extracting Earth's heat energy
PLO 23	To preserve and increase the moral, cultural, scientific values and achievements of society based on the understanding of the history and laws of the development of the oil and gas industry, its place in the general system of knowledge about nature and society and in the development of society.
PLO 24	Wield a methodology and methods of scientific cognition, carry on a dialogue when discussing theoretical, practical and other issues, study through reading primary sources and their analysis of the teachings of prominent philosophers of the past and present.
8 – Resourcing program implementation	
Staff assistance	It meets the personnel requirements for ensuring the implementation of educational activities in the field of higher education for the first (Bachelor's) level in accordance with the requirements of Appendix 12 to the Licensing conditions approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 p. № 1187 (with changes made in accordance with the Resolution of the CM № 347 from 10.05.2018).
Material and technical resources	It meets the technological requirements for material and technical provision of educational activities in the field of higher education in accordance to the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine " Approval of Licensing Conditions for Provision of Educational Activities in Educational Institutions" No. 1187 dated 30.12.2015 (as amended in accordance with CM Resolution No. 347 from 10.05.2018)).
Information and educational and methodological support	It meets the technological requirements for teaching and methodological provision of educational activities in the field of higher education in accordance to the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine " Approval of Licensing Conditions for Provision of Educational Activities in Educational Institutions" No. 1187 dated 30.12.2015 (as amended in accordance with CM Resolution No. 347 from 10.05.2018)).
9 – Academic mobility	
National Credit Mobility	Documents Containing Academic Mobility Regulations: Bilateral Cooperation Agreement with Kharkiv National University. VN Karazin (contract dated 25.12.2020)

International Credit Mobility	Agreements on International Academic Mobility (Erasmus + K1) with Universities: Istanbul Technical University (Turkish Republic), Brandenburg University of Applied Sciences (German Republic). Due to the accepted agreements, cooperation is carried out in the following areas: cooperation in the issues of students and postgraduate students recruitment and training; mutual visits and exchange of staff to carry out research and exchange of teaching experience; visits and exchanges of graduate and undergraduate students for study and research (long- and short-term programs); reciprocal visits of the managerial personnel of educational institutions.
Training of foreign applicants for higher education	Foreign students are taught in English and Ukrainian in separate groups. A separate discipline "Ukrainian as a Foreign Language" was introduced into the curriculum.

2. LIST OF EDUCATIONAL-PROFESSIONAL PROGRAM COMPONENTS

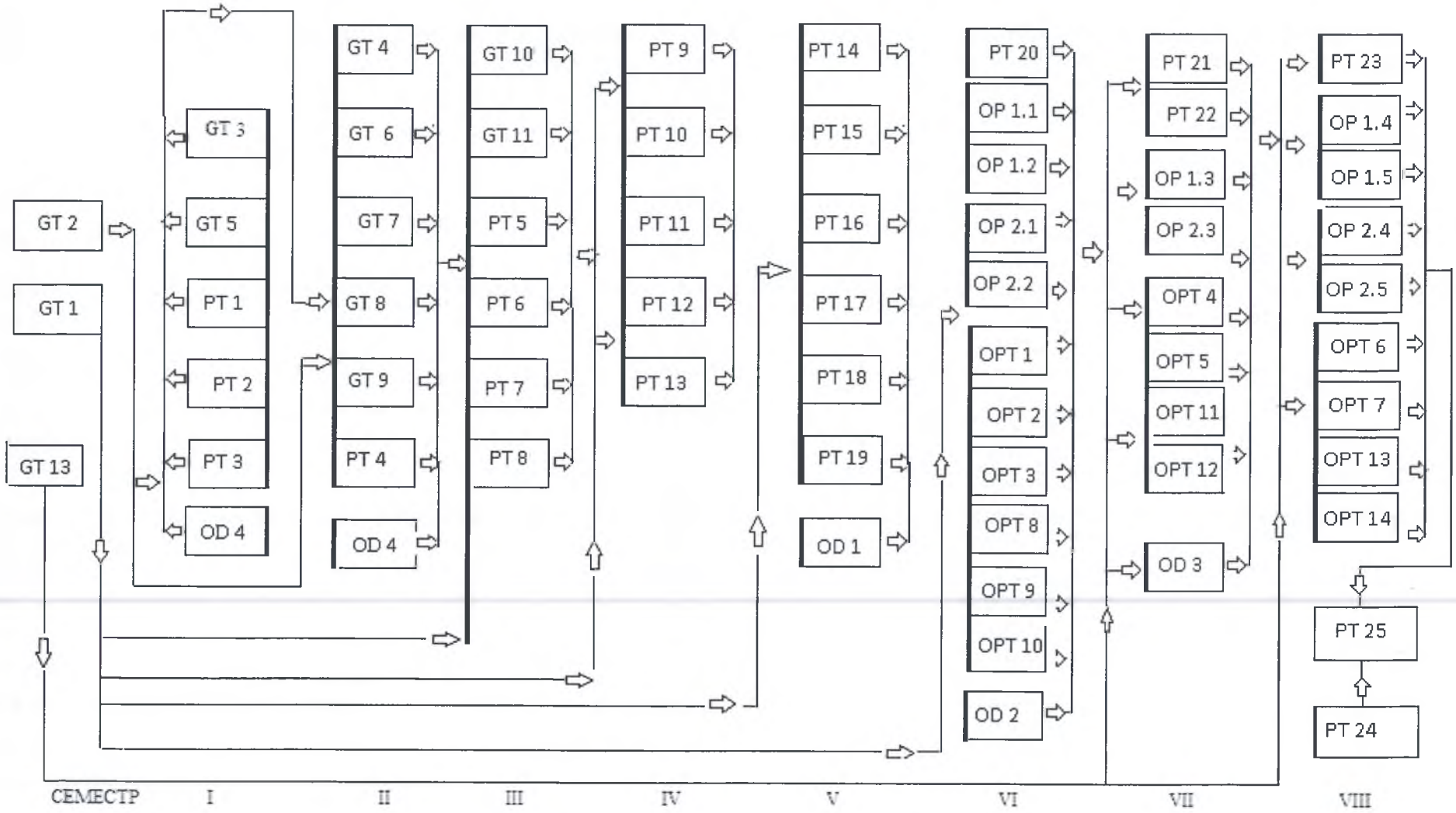
Code/subject	Components of the educational program (study disciplines, course projects / course works, practices, qualification work)	Credit hours	Form of final control (semester)
1	2	3	4
1. Compulsory educational components			
1.1 General training			
GT 1	Ukrainian as a foreign language	10,0	Tests Exam
GT 2	Professional language	9,0	Tests Exam
GT 3	Higher mathematics part 1	4,0	Exam
GT 4	Higher mathematics part 2	4,0	Exam
GT 5	Physics part 1	4,0	Exam
GT 6	Physics part 2	4,0	Exam
GT 7	General and inorganic chemistry	6,0	Exam
GT 8	History and culture of Ukraine	4,0	Exam
GT 9	Ecology	3,0	Tests
GT 10	Jurisprudence	3,0	Tests
GT 11	Organic chemistry	5,0	Exam
GT 12	Philosophy	3,0	Exam
GT 13	Foreigh language	4,0	Tests Exam
1.2 Professional training			
PT 1	Introduction to specialty	3,0	Tests

1	2	3	4
PT 2	Descriptive geometry, engineering and computer graphics	5,0	Exam
PT 3	Computational mathematics and programming p.1	5,0	Exam
PT 4	Computational mathematics and programming p.2	5,0	Exam
PT 5	Physical chemistry of disperse systems	5,0	Exam
PT 6	Physics and chemistry of fossil fuels	6,0	Exam
PT 7	Theoretical mechanics	4,0	Exam
PT 8	Resistance of materials	3,0	Tests
PT 9	Geology of oil and gas	6,0	Exam
PT 10	Applied mechanics	3,0	Tests
PT 11	The system of Geotechnology in oil and gas industry	6,0	Exam
PT 12	The theory of automatic control by technological processes	5,0	Exam
PT 13	Thermodynamics	5,0	Exam
PT 14	Physics of oil and gas reservoir	5,0	Exam
PT 15	Fundamentals of mining	4,0	Tests
PT 16	Gashydromechanics	5,0	Exam
PT 17	History of science and technology	3,0	Tests
PT 18	Theoretical fundamentals of oil and gas treatment technology	4,0	Exam
PT 19	Fundamentals of electronics, electrical equipment	3,0	Tests
PT 20	Fundamentals of Occupational Safety and Health	3,0	Exam
PT 21	Enterprise economics	3,0	Tests
PT 22	Technology of oil and gas production	5,0	Exam
PT 23	Fundamentals of research work	3,0	Exam
PT 24	Practice	9,0	Tests
PT 25	Attestation	3,0	Qualification exam
2 Optional educational components			
2.1 Profile training			
2.1.1 Profile disciplines package 01 «Development of oil and gas fields			
OP 1.1	Fundamentals of the technology of oil and gas wells drilling	5,0	Exam
OP 1.2	Search and exploration of oil and gas deposits	4,0	Tests
OP 1.3	Technology of development and operation of oil, gas and gas condensate fields	6,0	Exam
OP 1.4	Research and intensification of oil and gas wells	3,0	Exam
OP 1.5	Fundamentals of Industrial Geophysics	3,0	Tests
2.1.2 Profile disciplines package 02 "Oil and gas wells drilling"			
OP 2.1	Technology of drilling and repair of oil and gas wells	5,0	Exam
OP 2.2	Technical and technological calculations for drilling	4,0	Tests
OP 2.3	Research of exploration and oil and gas wells	6,0	Exam
OP 2.4	Problems and accidents when drilling wells	3,0	Exam
OP 2.5	Fundamentals of geophysical study	3,0	Tests
2.2 Optional disciplines for professional training due to the list			
ODP 1	Discipline 1	4,0	Exam
ODP 2	Discipline 2	3,0	Exam

1	2	3	4
ODP 3	Discipline 3	5,0	Exam
ODP 4	Discipline 4	5,0	Exam
ODP 5	Discipline 5	5,0	Exam
ODP 6	Discipline 6	3,0	Exam
ODP 7	Discipline 7	4,0	Exam
2.3 Optional disciplines for student`s choice from university catalog disciplines			
OD 1	Discipline 1	4,0	Tests
OD 2	Discipline 2	4,0	Tests
OD 3	Discipline 3	4,0	Tests
OD 4	Physical training	4,0	Tests
Total volume of **compulsory educational components**		**174,0**	
Total volume of **optional educational components**		**66,0**	
TOTAL VOLUME OF EDUCATIONAL PROGRAM		**240**	

2.2 Optional disciplines for professional training			
OPT 1	Well completion	4,0	Exam
OPT 2	Drilling Fluids	3,0	Tests
OPT 3	Modern methods of oil and gas processing on oil and gas fields	5,0	Exam
OPT 4	Technology of oil and gas production from offshore fields	5,0	Exam
OPT 5	Modelling of oil and gas condensate field development	5,0	Exam
OPT 6	Drilling technology for inclined and horizontal wells	3,0	Exam
OPT 7	Equipment for oil and gas fields	4,0	Exam
OPT 8	Fundamentals of oil and gas engineering	4,0	Exam
OPT 9	Modeling of technological processes in the oil and gas industry	3,0	Tests
OPT 10	Machinery and equipment for drilling oil and gas wells, equipment for production oil and gas	5,0	Exam
OPT 11	Automated equipment design system in oil and gas industry	5,0	Exam
OPT 12	Fundamentals of the theory of transport and underground hydrocarbon storage	5,0	Exam
OPT 13	Technology of collection and preparation of oil production	3,0	Exam
OPT 14	Technology of collection and preparation of gas production	4,0	Exam

1. STRUCTURAL-LOGICAL SCHEME OF EDUCATIONAL-PROFESSIONAL PROGRAM "OIL AND GAS ENGINEERING AND TECHNOLOGY"



4. FORM OF FINAL ACCREDITATION FOR HIGHER EDUCATION GRADUATES

Attestation for Higher Education Applicants by the "Oil and Gas Production" educational program, specialty-185 Oil and Gas Engineering and Technologies is conducted in the form of a qualification examination and ends with the issuance of a diploma certificate (diploma) for the award of his bachelor's degree and qualification : **Bachelor of Oil and Gas Engineering and Technology**

5. COMPLIANCE MATRIX OF PROGRAM COMPETENCIES TO COMPONENTS OF EDUCATIONAL PROFESSIONAL PROGRAM

	GT1	GT 2	GT 3	GT 4	GT 5	GT 6	GT 7	GT 8	GT 9	GT10	GT11	GT12	GT13	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6	PT 7	PT 8	PT 9	PT 10	PT 11	PT 12	PT 13	PT 14	PT 15	PT 16	PT 17
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	PT 18	PT 19	PT 20	PT 21	PT 22	PT 23	PT 24	PT 25	OP 1.1	OP 1.2	OP 1.3	OP 1.4	OP 1.5	OP 2.1	OP 2.2	OP 2.3	OP 2.4	OP 2.5	OP T1	OP T 2	OP T 3	OP T 4	OP T 5	OP T 6	OP T 7	OP T 8	OP T 9	OP T 10	OP T 11	OP T 12	OP T 13	OP T 14
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6. MATRIX SUPPORT OF PROGRAM LEARNING OUTCOMES BY RELATIVE EDUCATIONAL COMPONENTS OF EDUCATIONAL PROFESSIONAL PROGRAM

	GT1	GT 2	GT 3	GT 4	GT 5	GT 6	GT 7	GT 8	GT 9	GT 10	GT 11	GT 12	GT 13	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6	PT 7	PT 8	PT 9	PT 10	PT 11	PT 12	PT 13	PT 14	PT 15	PT 16	PT 17
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	PT 18	PT 19	PT 20	PT 21	PT 22	PT 23	PT 24	PT 25	OP 1.1	OP 1.2	OP 1.3	OP 1.4	OP 1.5	OP 2.1	OP 2.2	OP 2.3	OP 2.4	OP 2.5	OP T1	OP T 2	OP T 3	OP T 4	OP T 5	OP T 6	OP T 7	OP T 8	OP T 9	OP T 10	OP T 11	OP T 12	OP T 13	OP T 14
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PLO 11						+	+	+	+		+	+		+	+	+	+		+								+			+	+	
PLO 12																																
PLO 13							+	+	+			+		+			+									+			+	+		
PLO 14						+	+						+					+														
PLO 15					+	+																										
PLO 16			+																			+										
PLO 17								+			+														+					+		
PLO 18							+					+					+										+					
PLO 19				+				+							+																	
PLO 20		+	+																													
PLO 21				+			+	+														+										
PLO 22											+	+				+																
PLO 23																																
PLO 24																																