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GRADUATE MODEL (BACHELOR)

6B07204 - «Petroleum engineering» Educational Program

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FOREWORD

1 DEVELOPED by the department of "Petroleum Engineering" of the Institute of Petroleum Geology named after K. Turysov NJSC Kazakh National Research Technical University named after K.I. Satpayev

Head of Department of Scientific Research
«___» _____2022 _____G. Yeligbayeva

2 REVISED BY

Member of the Board - Vice-rector
for Academic Affairs _____B. Zhautikov
«____»_____2022

Director
Department of Academic Affairs _____ N. Zhunusbekova
«____»_____2022

Director
Institute of Petroleum Geology
named after K. Turysov _____ A. Syzdykov
«____»_____2022

Head of Evaluation and Quality Division _____ A. Sauranbayeva
«____»_____2022

Acting Head
of Legal Support and Public
Procurement Management _____ T. Abukenov
«____»_____2022

Responsible for the translation _____ G. Yeligbayeva
«____»_____2022

3 DISCUSSED and accepted by the Educational and Methodological Council of the Institute of Petroleum Geology named after K. Turysov (Protocol No._____ dated «_____» _____2022)

4 APPROVED by the Decision of the Board of NJSC Kazakh National Research Technical University named after K.I. Satpayev dated «_____» _____2022 No._____)

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INTRODUCTION

Graduate model – is a replication of the volume and structure of professional and socio-psychological qualities, knowledge, skills of a specialist, in the aggregate representing the specialist's generalized characteristics as a member of society.

An exemplar of a specialist with higher education, based on the study of personality characteristics and the structure of activities of persons who successfully work after graduation. The closer a student is to the date of graduation, the closer to the model should be his/her personal qualities, knowledge, skills and abilities.

Graduate model consists of four levels, each of which includes as follows. The first, highest level is the relationship level. At this level, the task of higher education is to form the knowledge and skills necessary for a specialist to understand other people, work together with them, manage relations with study and work mates.

The second level of behavior. The optimal behavior of a person presupposes the existence of scientific knowledge about the structure of the personality, the ability to understand one's strengths and weaknesses, take them into account in one's behavior both in relationships with other people and in one's own activities.

The third level – a level of activity. It is based on the structure of professional activity, educational activity and professional training.

The fourth – level of mental states. The successful activity of a specialist depends on the optimal activity of his/her personality. Low activity or high mental stress leads to the desired result at high costs or loss of time, energy and information. A specialist needs the ability to accurately assess own condition, mood, degree of mental tension in solving problems of varying complexity, to master the techniques of self-management.

1 Purpose and objectives of the 6B07204 - «Petroleum engineering» educational program

Purpose: Preparing a competitive generation of technicians for the oil and gas labor market.

Objectives of the educational program:

- Establishment of the necessary conditions for obtaining high-quality education in the chosen specialty, aimed at the formation, maturity, and professional development of the individual on the basis of national and universal values, achievements of science and practice.
- Ensuring the unity of goals and directions of development of educational services' QMS. Increasing the responsibility of the department's employees at all levels of activities to manage the quality of the educational process. Creation of a favorable internal environment and a motivation system that stimulates the achievement of specific results by all participants in the educational process.

favorable internal environment and a motivation system that stimulates the achievement of specific results by all participants in the educational process.

- Implementation and effective use of new technologies in education aimed to contribute to rapid adaptation of vocational education to the changing needs of the labor market, and aid each student in maximizing their personal potential.
- Development of creative and spiritual capabilities of students, creation of solid moral foundations and a healthy lifestyle, enrichment of the intellect by creating conditions for the development of individuality.
- Education of a person with an active civic position, the formation of the need to participate in the socio-political, economic, and cultural life of the republic, a conscious attitude of the individual's rights and duties.
- Integration into the world educational space.
- Integration of education, science and production.
- Creation of conditions for advanced training of teachers and staff.
- Strengthening the image of the department, institute and university.

Legal Framework and Recommended Practices Used for «Petroleum Engineering» EP Development:

– Law of the Republic of Kazakhstan dated July 27, 2007 No. 319-III "On Education";

– Decree of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080 "On Approval of State Compulsory Education Standards for the Relevant Levels of Education";

– Decree of the Government of the Republic of Kazakhstan dated May 17, 2013 No. 499 "On approval of the Model Rules for the Activities of Educational Organizations of the Respective Types, including the Model Rules for Educational Organizations Implementing Additional Educational Programs for Children" (as amended on April 7, 2017);

– State obligatory standard of education SOSE 03.08.334.- 2006, specialty 050708 - "Oil and Gas Business";

2 Subjects of professional activity

An area of professional activity or a ***professional group*** is a set of types of labor activity in an industry that has a common integration basis (similar or similar purposes, objects, technologies, including labor tools) and implies a similar set of labor functions and competencies for their performance.

A type of labor activity or a ***professional subgroup*** is a part of a professional group, a set of professions formed by a holistic set of labor functions and the competencies necessary for their performance.

In Table. 1 shows 5 main areas of professional activity and 21 types of labor activity for graduates of the "Petroleum Engineering" EP, according to the industry qualifications framework. It should be noted that the experience of the global oil and

gas industry in the classification of the main areas of professional activity was considered when developing the "Petroleum Engineering" EP. For example, the current ORC classification omits the direction "Development of oil and gas fields" - physico-chemical methods, mechanisms, and processes occurring in the reservoir and a qualitative description of these phenomena. Thus, the OP "Petroleum Engineering" includes the best world practices of the oil and gas industry, at the same time based on existing historical traditions.

Areas of professional and types of work in the oil and gas industry, according to the SQF (6-level: undergraduate)

Table 1

Professional group	**Professional Subgroup**
Oil and gas exploration	Geological and geophysical work on oil and gas exploration
Drilling oil and gas wells	Drilling management
Oil and gas	Manufacturing control; Maintenance and repair of special equipment and field equipment; Operation of oil and gas wells; Reservoir pressure maintenance; Underground well repair; Overhaul of wells; Treatment and pumping of oil and gas; Well research.
Oil transportation	Manufacturing control; Operation of main oil pipelines; Oil transportation services; Operation of technological equipment; Diagnostics of technological equipment and linear part of main oil pipelines; Maintenance funds electrochemical protection.
Gas transportation	Manufacturing control; Operation and repair of HST, gas facilities; Operation and repair of the linear part of the main pipeline; Operation and repair of CS; Commodity transport operations MP.

3 Descriptors

Bachelor of 6B07204 - «Petroleum engineering» EP

The scope of professional activity of the bachelor of EP 6B07204 - "Petroleum engineering" are the types of professional activity:

– production and technological - at fields and enterprises directly involved in production, field and factory preparation, transportation and storage of oil, oil products and gas;

– production and management - at fields and enterprises, in companies and organizations of the oil industry with a certain production experience;

– design and engineering - in design and engineering institutes, bureaus and organizations involved in the design processes, technologies and equipment for the development, operation, transport and storage of oil and gas;

– research - in research institutes and laboratories for the study of reservoirs and wells, physical and chemical properties of reservoir fluids pumped and stored liquids and gases.

The objects of professional activity of the bachelor of 6B07204 - "Petroleum engineering" EP are deposits and enterprises, engaged in the development, operation of fields, design and operation of gas and oil pipelines, gas and oil and filling stations.

The objects of professional activity of the bachelor 6B07204 - «Petroleum engineering» EP are deposits and enterprises, engaged in the development and operation of oil and gas fields, field, main and technological pipelines; mechanical equipment, including components and assemblies of the mechanical drive of installations; pumping and compressor stations; storage tanks for hydrocarbons.

4 General competencies

4.1 Social and humanitarian

Knowledge of the laws of socio-economic development of society, the history of Kazakhstan, the state language, foreign and Russian languages as a means of interethnic communication. Understanding the significance of one's social functions as a citizen of one's country, a member of society, a stable positive attitude towards one's social duties. Knowledge of state symbols (coat of arms, flag, anthem). Knowledge of the rights and freedoms of man and citizen, the ability to implement them in various life situations. The ability to correlate personal interests with the interests of society. Aiming at the improvement and development of society on the principles of humanism, freedom, and democracy. Experience of socially useful civil activity. The ability to take responsibility, to participate in the functioning of democratic institutions. The need for self-development. A graduate must have a culture of thinking, know its general laws, be able to present the results correctly and logically in written and verbal form. Knowledge and observance of traditions, ritual, etiquette, the ability constructively communicate and observe its optimal duration; the ability to conduct a civilized dialogue. Knowledge of constructive ways to resolve conflict and correct broken relationships. Public speaking and writing skills, experience of interacting with different people (by age, activity), ability to build

partnerships, ability to work in a team. The graduate must know the ethical and legal norms, the relationship of man to man, society, environment.

4.2 Economic, organizational, and managerial

The graduate must know the basics of industrial relations, the principles of management, taking into account technical, financial and human factors, must master the basics of economic analysis and be ready to perform organizational and managerial functions in a team.

4.3 General scientific

Providing deep knowledge of natural science, general technical nature as the foundation of vocational education. Provide the study of disciplines: mathematics, physics, chemistry, descriptive geometry and computer graphics.

Information competence should also be classified as general scientific: computer literacy, acquiring of new multimedia information technologies.

4.4 General technical

Bachelor should be competent in all issues related to stages of technological processes, labor safety in production, and environmental protection. Bachelor to be provided with the study of disciplines: thermodynamics and heat transfer computer science, applied mechanics, strength of materials, ecology and sustainable development, strength of materials, hydraulics.

The professional opportunities of a bachelor in modern conditions must meet the requirements of the global international labor market. The bachelor must be ready to change social, economic, professional roles, must be geographically and socially mobile in the face of increasing dynamic changes and uncertainties.

5 Professional competencies

The purpose of the cycle of major disciplines (MD) is to provide deep theoretical knowledge and practical experience in the field of development, operation, transportation and storage of oil and gas.

5.1 Evaluation and planning activities

- collecting and analysis of initial informational data;
- evaluation and engineering of oil and gas fields, pipelines and storages in accordance with assignment with the use of standard means of engineering;
- development of design and working documentation, layout of complete design and development works;
- control of conformity of the projects developed and technical documentation

standards, as well as other normative documentation standards.

- conducting preliminary technical and economical project evaluation;

5.2 Production and technological activities

- carry out technological processes of construction, repair, reconstruction and restoration of oil and gas wells;
- conduct technological processes of operation and carry out technological maintenance of equipment used in the construction, repair, reconstruction and restoration of oil and gas wells;
- carry out technological processes of oil and gas production, collection and preparation of well products;
- operate and maintain process equipment used in oil and gas production, collection and preparation of well products;
- carry out field control and regulation of hydrocarbon extraction;
- carry out technological processes of pipeline transportation of oil and gas, underground gas storage;
- operate and maintain process equipment used in oil and gas pipeline transportation, underground gas storage;
- carry out technological processes of storage and marketing of oil, oil products and liquefied gases;
- operate and maintain technological equipment used in the storage and sale of oil, oil products and liquefied gases;
- perform technical work in accordance with the technological regulations for drilling, development and development of oil and gas fields, transportation and storage of hydrocarbons;
- perform work in one or more professions of workers, positions of employees;
- draw up technical and technological documentation for the operation of oil and gas equipment;

5.3 Experimental research activity

- analyze information on technological processes and technical devices in the field of oil and gas production, field control and regulation of hydrocarbon extraction, oil and gas pipeline transport, underground gas storage, storage and marketing of oil, oil products and liquefied gases;
- conduct experimental studies of technological processes and technical devices regulated by methods in the field of oil and gas production, field control and regulation of hydrocarbon extraction, oil and gas pipeline transport, underground gas storage, storage and marketing of oil, oil products and liquefied gases;
- perform statistical processing of the results of experiments, draw up reporting documentation;
- project activity:

- collect and submit, in accordance with the established form, initial data for the development of project documentation for oil and gas production, field control and regulation of hydrocarbon extraction, oil and gas pipeline transport, underground gas storage, storage and marketing of oil products and liquefied gases;
- perform calculations using applied software products for the design of oil and gas production, field control and regulation of hydrocarbon recovery, pipeline transportation of oil and gas, underground gas storage, storage and marketing of oil, oil products and liquefied gases;
- draw up standard design, technological and working documents in accordance with the established requirements;
- participate in the preparation of design solutions for quality management in oil and gas production.

5.4 Organizational and managerial activities

- plan, organize and manage the work of primary production units of enterprises, oil and gas production, field control and regulation
- extraction of hydrocarbons, pipeline transportation of oil and gas, underground gas storage, storage and sale of oil, oil products and liquefied gases;
- document the processes of planning, organizing and managing the work of primary production units of enterprises engaged in drilling wells, oil and gas production, field control and regulation of hydrocarbon extraction, pipeline transportation of oil and gas, underground gas storage, storage and marketing of oil, oil products and liquefied gases;
- analyze the activities of primary production units of enterprises engaged in oil and gas production, field control and regulation of hydrocarbon extraction, oil and gas pipeline transport, underground gas storage, storage and marketing of oil, oil products and liquefied gases;
- control the compliance of developed projects and technical documentation with standards, specifications and other regulatory documents;
- develop an operational plan for the work of primary production units;
- to carry out the placement of technological equipment, technical equipment and organization of workplaces, calculation of production capacities for loading equipment according to current methods and standards;
- participate in the work of the quality management system at the enterprise;
- participate in the development of organizational and technical documentation (work schedules, instructions, plans, estimates) and established reporting in accordance with approved forms;

Installation and adjustment activities

- adjustment, adjustment, adjustment and experimental verification of equipment and software;

- installation, adjustment, testing and commissioning of prototypes of products, assemblies, systems and parts of manufactured products.

5.5 Service and maintenance activities

- setup and maintenance of hardware and software;
- checking the technical condition and residual life of the equipment, organization of preventive inspections and repairs;
- acceptance and development of the equipment being commissioned;
- preparation of applications for equipment and spare parts, preparation of technical documentation for repairs;
- coordination of personnel work for complex problem solving - from idea to serial production.

5.6 Functions of professional activity

In professional activities the bachelor performs the following functions:
- work on the preparation of technical documentation under established reporting according to approved forms;
- training and briefing on safety, labor protection and the environment;
- monitoring compliance with the requirements of documentation on quality management of technological production sites.

5.7 Standard tasks of professional activity

The bachelor should be prepared to deal with the following issues:
- selection of technology for the development of oil and gas fields;
- selection of equipment and its mode of operation during well operation;
- testing of automation equipment according to standard methods;
- production management at the level of production sites:
- selection of a scheme for collecting oil, gas and water in the fields;
- selection of a transportation scheme;
- interpretation of well operation characteristics;
- implementation of a comprehensive analysis of the state of development;
- analysis and adoption of measures for labor safety in production, environmental protection.

5.8 Direction of professional activity

The following areas of professional activity can be distinguished: work at enterprises for the development and operation of oil and gas fields, processing and production of petroleum products, in service and contracting organizations of the oil

and gas industry, bodies of the Ministry of Emergency Situations, state technical supervision, environmental and regulatory organizations, consulting organizations.

The content of professional activity

The content of professional activity includes:

– development of schemes for collecting oil in the fields, designing field oil pipelines, maintenance of equipment for measuring well production, maintenance of pumping booster stations, equipment for preparing oil for transportation, technological regulations of installations;

– maintenance of technological gas collection and treatment units, low-temperature separation and adsorption units, maintenance of integrated gas treatment units;

– construction of main oil pipelines, maintenance of oil pumping stations, regulation of the operation of stations and oil pipelines;

– construction of main gas pipelines, maintenance of compressor stations, joint operation of stations and gas pipelines;

– construction of oil storage facilities, gas storage facilities, maintenance of equipment for the transportation of liquefied gases and gas hydrates, maintenance of oil and gas stations.

5.9 Requirements for the key competencies of a bachelor in the 6B07204 - "Petroleum engineering" specialty

For a competent and responsible solving of professional issues the bachelor must:

Know:

– the state and prospects for the development of technologies for the development of oil and gas fields;

– about modern equipment and advanced technologies for drilling, collecting and preparing;

- about modern methods and technologies of transportation and storage of oil, gas and oil and gas products, about the problems of transportation and storage of oil and gas and ways to solve them;

- basics of designing oil and gas facilities production as technological systems;

Learn:

- physical processes occurring in the reservoir during filtration liquids and gases;

- general principles of oil and gas development technology deposits;

- general principles of drilling and workover technology;

- fundamentals of the theory of liquid rise to the surface;

- technology of impact on the bottomhole zone of wells;

- technology for collecting oil, gas and water in the fields;

- oil and gas transportation and storage technology;

Be able to:

– choose technology for the development of oil and gas fields;

– select equipment and set the mode of its operation during well operation;

– choose a scheme for collecting oil, gas and water in the fields;

– select transportation schemes have skills;

– control, analyze and regulate the development of oil, gas and gas condensate fields;

– record and interpret well operation characteristics;

– conduct a comprehensive analysis, evaluate the state of development (development projects) of oil fields (technical and economic, resource and energy, environmental analyzes);

Have skills to:

- search for and apply up to date information;
- apply research tools;
- use metrological rules and norms;
- apply safety regulations;
- apply computer technologies in solving production issues.

Be competent in all issues related to the stages of the technological process, labor safety in production, environmental protection

5.10 Main national goals of education and hierarchy of goals (as per discipline cycles)

Preparation of a bachelor of 6B07204 - "Petroleum engineering" specialty pursues the following goals:

- to practically implement the democratic principles of managing the educational process, to expand academic freedom and opportunities for higher education:
- to ensure the adaptation of higher education in the specialty and scientific research to the changing needs of society and the achievements of scientific thought;
- to ensure recognition of the level of training of specialists in other countries;
- to ensure higher mobility of graduates in the changing conditions of the labor market.

The purpose of the cycle of general education disciplines (GED) is to provide social and humanitarian education based on knowledge of the laws of socio-economic development of society, the history of Kazakhstan, modern information technologies, the state language, foreign and Russian languages, as a means of interethnic communication.

The purpose of the cycle of basic disciplines (BD) is to provide in-depth knowledge of the natural sciences, general technical and economic nature, as the foundation of vocational education.

The purpose of the cycle of major disciplines (MD) is to provide deep theoretical knowledge and practical experience in the field of technological machines and equipment

5.11 Requirements for the level of education of graduates

5.11.1 General education requirements

The main requirement for general education is that a graduate receives a full-fledged and high-quality professional education, confirmed by the level of knowledge, skills, abilities and competencies based on the criteria established by the state general education standard, their assessment both in content and in volume.

5.13.2 Requirements for social and ethical competence

The graduate must master the humanitarian culture, ethical and legal norms of relations to man, society and the environment, the culture of thinking

5.13.3 Requirements for economic and organizational and managerial competencies

The graduate must master the basic laws of economic development, factors affecting the technical and economic efficiency of production, knowledge of sociology and psychology in enterprise management, the ability to qualitatively justify management decisions.

5.13.4 Professional competence requirements

A graduate must have professional knowledge in his subject area, know the basics of industrial relations and management principles, taking into account technical, financial and human factors.

The graduate must acquire a system of knowledge on the creation and application of modern technologies in their subject area and related areas; in accordance with the educational trajectory and field of activity chosen by him, must have sufficient knowledge, skills, abilities and competencies for the competent setting and solution of design, operational, experimental research or design problems in his subject area.

5.13.5 Requirements for readiness to change social, economic, professional roles, geographic and social mobility in the face of growing dynamic changes and uncertainties

The professional capabilities of a bachelor specialist in modern conditions must meet the requirements of the global international labor market. A bachelor specialist must be ready to change social, economic, professional roles, must be geographically and socially mobile in the face of increasing dynamic changes and uncertainties.

5.13.6 Educational requirements for the main cycles disciplines

Requirements for education in the main cycles of academic disciplines with the specific content of the working curricula of the specialty. To acquire a set of professional, intercultural, and communicative competencies, a graduate must

master the knowledge of a set of general education (GED), basic (BD) and profile (PD) disciplines, both their mandatory component and the optional component in accordance with the chosen educational trajectory in full (not less than 135 (230 credits) established by the state standard.

MATRIX
of competence for 6B07204 - «Petroleum engineering» EP Bachelor

The matrix of professional competence, which determines the required level of knowledge for bachelors of oil and gas engineering, was adopted as the basis for the competence matrix of the bachelor of knowledge for bachelors in operation and service technological equipment.

Matrix of competence 1
General technical knowledge of the bachelor 6B07204 - «Petroleum engineering» EP

Requirements	Studied in the disciplines listed below	Comments
Understanding and using terminology	Introduction to the specialty	Terms and definitions in the oil and gas industry
Definition and use of technical software and information database	Information and Communication Technologies Basics of Data Analytics and Programming for Petroleum Engineers	Knowledge of modern information technologies Knowledge of the principles and design of building application programs
Using Project Management Skills Evaluation of project economics	Economic evaluation of oil and gas projects Course and diploma design	Understanding project controls Understanding basic economic principles Performing economic evaluation of projects
Decision making and risk analysis, contingency planning	Life safety Ecology and sustainable development	Risk analyzes during equipment operation Understanding the safety requirements for field operation, oil and gas transportation
Understand professional and ethical responsibility	Solving the problems of oil and gas engineering Geology and mineral resources of Kazakhstan	Practice ethical, social, and environmental standards in their professions in a responsible manner
Participation in multidisciplinary teams	Multidisciplinary project design Participation in public events, participation in the student society of petroleum engineers.	Understanding the effectiveness of a multidisciplinary approach in solving professional issues
Fulfillment of duties within the framework of ethical standards of conduct	Internal regulations in educational buildings and hostels.	Understanding internal rules of conduct for general practice

Promoting Professionalism in Engineering	Participation in student scientific conferences, subject Olympiads, in the student society of oil engineers.	Active participation in technical and professional societies and obtaining professional licenses and certificates.

Matrix of competence 2

Professional knowledge and skills of the bachelor 6B07204 - «Petroleum engineering» EP

Requirements	Studied in the disciplines listed below	Comments
Apply knowledge of mathematics, science and technology. Identify, formulate and solve technical problems	Disciplines related to the study of field development technology, transportation and storage of oil and gas	Apply knowledge of mathematics, science and technology, as well as identify, formulate and solve engineering problems to improve the technological processes of the oil and gas industry.
Design and conduct experiments and analyze and interpret data	Computer-Aided Design Systems	Demonstrate a high level of competence in engineering principles and practice.
Design a system, component, or process to meet desired needs within realistic constraints	Solving the problems of oil and gas engineering	Demonstrate a high level of competence in engineering principles and practice.
Monitoring and optimization of well stimulation regimes	Disciplines related to the analysis and study of technologies for the intensification of oil production.	Monitoring and analysis of operations, issuing recommendations for optimizing the modes of operation of deposits
Understand the impact of technical solutions in a global, economic, environmental and social context	Legal and regulatory framework for subsoil use	Serve the society, the oil and gas industry, the state through participation in professional communities and public organizations
Recognize the need for lifelong learning and self-learning. Know current issues	Oil and Gas Engineering Seminar. Participation in scientific communities, publication of research in conference proceedings and journals.	Demonstrate a high level of competence in engineering principles and practice.
Use the methods, skills and modern engineering tools required for engineering practice	Educational and industrial practice. Complex graduation projects, participation in social events,	Identify, formulate and solve engineering problems to improve the technological processes of the oil and gas industry.

Expected results by years of study:
1st year of studies

The formation of the personality, ethical and legal foundations of the student's behavior is carried out. The general provisions of the laws of socio-economic development of society, the history of Kazakhstan are fundamentally fixed, knowledge (to a professional level) of the state language, foreign and Russian languages is being improved and deepened.

There is a further improvement of the apparatus of mathematical analysis and skills in the natural sciences, the development of elements of computer graphics and the logical apparatus of descriptive geometry for a further transition to a deeper study of general scientific and general technical disciplines.

2nd year of studies

There is a further establishment of a technical foundation for the profession based on an in-depth study of general scientific and general technical disciplines. Information competence is being strengthened: computer literacy, knowledge of new information and multimedia technologies.

The student masters the basics of industrial relations and management principles, taking into account technical, financial and human factors, the basics of economic analysis.

The foundations of basic knowledge in the specialty are laid by mastering the mechanics of fluids, thermodynamics, and heat engineering of processes. There is a further improvement of the general training of a specialist on the basis of deeper language training (English, Russian, Kazakh technical languages).

3rd year of studies

The student masters advanced methods of exploitation of oil and gas fields; rights and obligations of service personnel at enterprises and deposits; requirements, but rational and safe conduct of work, using technological machines and equipment.

The student uses computer means of work intensification when performing educational tasks; studies and practically masters modern and promising means of mechanization of labor-intensive work; gets acquainted and practically masters the methods of ensuring environmental safety in the operation of oil and gas fields, transportation and storage of oil and gas; gets acquainted with the requirements and content of design and technical documentation for the operation of process equipment; documents regulating the selection, development and operation of fields, transportation and storage of oil and gas, electronic and measuring equipment, instruments and systems for monitoring production processes; studies and masters the economic methods of enterprise management and the scientific organization of

labor; professionally consolidates the acquired knowledge and practical skills in industrial practice.

4th year of studies

The student learns the methods of carrying out calculations and methods of diagnosing the equipment of gas and oil pipelines; understands how to design and carry out load calculations on main pipelines; masters the basics of selecting a variety of pumps for pumping oil products; learns to calculate the reliability of oil and gas facilities using modern methods of computer technology; masters the basics of resource conservation issues and studies methods for assessing the impact of the operation of technological machines and equipment on the environment. Based on the acquired knowledge and skills, the student prepares a graduation project in accordance with the assignment issued by the project manager.