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GRADUATE MODEL (MASTER)

7M07202 - «Petroleum Engineering» Educational Program

MC 029-03-04-02.1.02 - 2022

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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

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TABLE OF CONTENT

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.

The main professional educational program (hereinafter - EP) of the master's program, implemented by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan in the direction of training "Petroleum Engineering" is a system of documents developed and approved taking into account the requirements of the labor market on the basis of the state educational standard of higher education.

The EP regulates the goals, expected results, content, conditions and technologies for implementing the educational process, assessing the quality of a graduate's training in this area of training and includes the curriculum, work programs of modules/disciplines, practice programs, final state certification and other materials to ensure quality education.

The development and management of the educational program of postgraduate education "Petroleum Engineering" is carried out in accordance with the standard and working curriculum in the specialty 05070800 "Oil and Gas Business", developed by the Kazakh National Research Technical University named after K.I.Satpaev and approved in the prescribed manner.

developed by the Kazakh National Research Technical University named after K.I.Satpaev and approved in the prescribed manner.

The educational program submitted for accreditation complies with the requirements of the State Compulsory Standard of Postgraduate Education. The implementation of the educational program and the strategy for its development is carried out by the Department of Petroleum Engineering of the Institute of Geology and Oil and Gas Business named after K. Turysov.

1 Purpose and Objectives of 7M07202 - «Petroleum Engineering» Educational Program

Purpose: Preparation of a competitive generation of technical specialists for the labor market of the oil and gas industry; formation of general cultural competencies of graduates (competencies of social interaction, self-organization and self-management, system-activity nature); formation of general professional and professional competencies of graduates.

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 based on 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.
- 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.

Table 1 demonstrates 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. 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: postgraduate)

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 of electrochemical protection equipment
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

Postgraduate studies, 7M07202- «Petroleum engineering» EP

The scope of professional activity of the Master's of EP **7M07202-** "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 Master's of 7M07202 - "Petroleum engineering" EP 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 Master's of **7M07202** - «Petroleum engineering» EP is the fields 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.

The requirements for the level of preparation of a master's student are determined based on the Dublin descriptors of the second level of higher education (master's) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect the learning outcomes that characterize the student's abilities to:

1) demonstrate evolving knowledge and understanding in the field of Oil and Gas, based on advanced knowledge of the field in the development and (or) application of ideas in the context of the study;
2) formulate and solve problems that arise in the course of research and practical activities;
3) use program-target methods for solving scientific problems;
4) independently master new research methods, modify them and develop new methods based on the objectives of a particular study;
5) use the methodology of scientific research in professional activities;
6) apply at a professional level their knowledge, understanding and abilities to solve problems in a new environment, in a broader interdisciplinary context;
7) collect and interpret information for the formation of judgments, taking into account social, ethical and scientific considerations;
8) communicate clearly and unambiguously ideas, conclusions, problems and solutions to both specialists and non-specialists;
9) demonstrate learning skills necessary to independently continue further education in the oil and gas industry.

4 General Competencies

Graduate should have the following general professional competencies:

- ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- ability to independently formulate research goals, establish a sequence for solving professional problems;
- ability to apply in practice the knowledge of fundamental and applied sections of disciplines that determine the direction (profile) of the master's program;

- ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems;

- ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities;

– skills in compiling and designing scientific and technical documentation, scientific reports, reviews, reports and articles;

- readiness to lead a team in the field of their professional activity, tolerantly perceiving social, ethnic, confessional and cultural differences;

- readiness to communicate orally and in writing in a foreign language to solve the problems of professional activity.

Graduate must have professional competencies corresponding to the types of professional activities that the master's program is focused on:

research activities:

- ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge obtained during the development of the master's program;

- ability to independently conduct scientific experiments and research in the professional field, summarize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;

- ability to create and explore models of the objects under study based on the use of in-depth theoretical and practical knowledge in the field of oil and gas business

research and production activities:

– ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;

– ability to professionally operate modern field and laboratory equipment and instruments in the field of the program;

- ability to use modern methods of processing and interpreting complex information to solve production problems;

project activities:

– ability to independently draw up and present projects of research and development work;

– readiness to design complex research and scientific and production works in solving professional problems;

organizational and managerial activities:

- readiness to use practical skills in organizing and managing research and development work in solving professional problems;

- readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;

– *scientific and pedagogical activity:*

- the ability to conduct seminars, laboratory and practical classes;

- the ability to participate in the management of the scientific and educational work of students in the field of oil and gas business.

5 Experimental Research Activity

Master's graduate should be able to perform the following functions:

- plan and conduct analytical, simulation and experimental studies, critically evaluate data and draw conclusions;
- to conduct an economic analysis of the costs and effectiveness of technological processes and industries;
- control over compliance with the requirements of documentation on | quality management of technological production sites.

6 Standard Tasks of Professional Activity

Master's graduate should be prepared to deal with the following:

- formulate and solve problems that arise in the course of research and practical activities;
- improve methods of operation and equipment maintenance technologies;
- use the methodology of scientific research in professional activities;
- use professional software systems in the field of mathematical modeling of technological processes and objects;
- to analyze and systematize scientific and technical information on the topic of research, to select methods and means of solving the problem, to conduct patent research in order to ensure the patent purity of new developments;
- develop scientific and technical, design and service documentation, draw up scientific and technical reports, reviews, publications based on the results of the studies;

7 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.

8 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.

9 Requirements for the Key Competencies of a Master's Student in the 7M07202- "Petroleum Engineering" Specialty

For a competent and responsible solving of professional issues Master's graduate must:

1) Have an understanding of:

– the role of science and education in public life;

– current trends in the development of scientific knowledge;

– topical methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

- the professional competence of a teacher of higher education;

– the contradictions and socio-economic consequences of globalization processes;

2) Have knowledge of:

- methodology of scientific knowledge;

– principles and structure of organization of scientific activity;

- psychology of cognitive activity of students in the learning process;

- psychological methods and means to improve the efficiency and quality of education;

3) Be able to:

– use the acquired knowledge for the original development and application of ideas in the context of scientific research;

- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;

- integrate knowledge gained within different disciplines to solve research problems in new unfamiliar conditions;

- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;

- apply the knowledge of pedagogics and psychology of higher education in their teaching activities;

- apply interactive teaching methods;

- carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- think creatively and creatively approach the solution of new problems and situations;
- to be fluent in a foreign language at a professional level, allowing to conduct scientific research and teach special disciplines in universities;
- summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc.;

4) Have skills to:

- research activities, solving standard scientific problems;
- implementation of educational and pedagogical activities on credit technology of education;
- methods of teaching professional disciplines;
- the use of modern information technologies in the educational process;
- professional communication and intercultural communication;
- oratory, the correct and logical formulation of one's thoughts in oral and written form;
- expanding and deepening the knowledge necessary for everyday professional activities and continuing education in doctoral studies.

5) Be competent in

- the field of scientific research methodology;
- the field of scientific and scientific-pedagogical activity in higher educational institutions;
- matters of modern educational technologies;
- the implementation of scientific projects and research in the professional field;
- ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

10 Main National Goals of Education and Hierarchy of Goals (as per discipline cycles)

Preparation of a Master's graduate of 7M07 - "Petroleum engineering" 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

11 Requirements for the Level of Education of Graduates

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.

- 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

- 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.

- 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.

- 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.

- 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 60 (120 credits) established by the state standard.

MATRIX
of Competence for 7M07202 - «Petroleum Engineering»

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

Matrix of Competence 1
General technical knowledge of the master's program 7M07202 - «Petroleum Engineering»

Requirements	Studied in the disciplines listed below	Comments
Acquirement of the didactic foundations of the organization of the learning process in higher education	Psychology of management Pedagogy of higher education	Understanding of discussion and dialogue techniques
Understanding and using terminology	Research Seminar for Petroleum Engineers Foreign Language (professional)	Terms and definitions in the oil and gas industry
Definition and use of technical software and information database	Reservoir Modeling: Compositional model Reservoir Modeling: Black-oil model	Ability to work in application packages for planning and processing the results of an experiment, the use of mathematical modeling methods in scientific research;
Effective communication skills for in professional environment	Psychology of Management History and Philosophy of Science	Communication skills and creativity in professional activities
Competent presentation of thoughts in oral and written speech, understand specific terminology	Life Safety Ecology and Sustainable Development	Understanding the safety requirements for field operation, oil and gas transportation
Independent analysis and selection of specialized literature.	Research Seminar for Petroleum Engineers Research work of a master student, including receiving a 'pass'	Understanding the effectiveness of a multidisciplinary approach in solving professional issues
Critical analysis of information, summarizing and annotating the text	Participation in public events, participation in the student society of petroleum engineers.	Understanding internal rules of conduct for general practice
Fulfillment of duties within the framework of ethical standards of conduct	Internal Regulations in Educational Buildings and Dormitories.	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 master's program graduate for 7M07202 - «Petroleum Engineering»

Requirements	Studied in the disciplines listed below	Comments
Solve standard tasks of professional activity based on information and bibliographic culture using information and communication technologies considering the basic requirements of information security	Disciplines related to the study of advanced technologies for field development, transportation and storage of oil and gas	Present the results of analytical and research work verbally, and in writing in a form of a report, review, article.
To carry out the setting of professional tasks in the field of research and practical activities	Disciplines related to the study of advanced oil production technologies	Identify the principal sources of formation energy Calculate the physical properties of formation oils and formation waters
Apply knowledge of mathematics, science and technology to identify distinctive features and deposits, analysis and development design		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	Disciplines related to scientific research Research work of a master student, including the passage	Demonstrate a high level of competence in engineering principles and practice.
Design a system, component, or process to meet desired needs within realistic constraints	Disciplines related to the study of advanced technologies for the design and operation of gas and oil storage facilities	Demonstrate a high level of competence in engineering principles and practice.
Monitoring and optimization of well stimulation regime	Disciplines related to the analysis and study of technologies for the intensification of oil production.	Performing monitoring and analysis of operations, issuing recommendations for optimizing the modes of operation of deposits
Understand the impact of technical solutions in a global,	Well Construction and Workover Supervision	Serve the society, the oil and gas industry, the state through participation in professional

economic, environmental and social context		communities and public organizations
Recognize the need for lifelong learning and self-learning. Be aware of current issues	Participation in Scientific Communities, Publication of Research in Conference Proceedings and Journals.	Demonstrate a high level of competence in engineering principles and practice.
Use methods, skills and modern engineering tools required for engineering practice	Research conducted by the student, Internship at a research institute Master's theses, 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

Advance formation of the personality, ethical and legal foundations of the student's behavior is carried out. General provisions on the history and philosophy of science, psychology of management, teaching for higher education institutes are being developed, knowledge of a foreign language is being improved and deepened at a professional level.

There is advance of the apparatus of mathematical modeling, programming for petroleum engineers. The skills of undergraduate research work are instilled based on the implementation of research work on the topic of the dissertation.

2nd year

Additional formation of core technical knowledge for this profession on the basis of an in-depth study of advanced 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, considering technical, financial and human factors, the basics of economic analysis.

The basic knowledge of the specialty is improved by mastering advanced levels of thermodynamics and phase states of reservoir fluids, reservoir modelling: Compositional model and Black-oil model, supervising the construction and workover of wells, methods for improving the efficiency of gas and oil pipelines, the basics of statistics for petroleum engineers.

The skills of research work of a master's student are instilled on the basis of scientific internships and the implementation of research work on the topic of the dissertation.

Based on the acquired knowledge and skills, a master's thesis is prepared

Amendment registration sheet for _____

(document)

Serial number of change	Section, paragraph of the document	Type of amendment (replace, cancel, add)	Number and date of notification	Amendment made	
				Date	Surname, initials, signature, position