THE MINISTRY OF EDUCATION AND SCIENCE OF THE
REPUBLIC OF KAZAKHSTAN
M.Auezov SOUTH KAZAKHSTAN UNIVERSITY

« APPROVED BY»
The Rector
d.h.s., academician Kozhamzharova D.P.
«25» 02 2021

EDUCATION PROGRAMME

7M07173 – «**Petrochemistry**»

Registration number	7M07100036
Code and classification of the field of education	7M07 - Engineering, manufacturing and construction industries
Code and classification of training areas	7M071- Engineering and engineering practice
Group of educational programs	M097 Chemical Engineering and processes
Type of EP	Updated
ISCE level	7
NQF level	7
SQF of education level	7
Language of learning	Russian
Typical duration of study	2 years
Form of study	Scientific-pedagogical
The complexity of the EP,	120 credits
Distinctive features of EP	-
University Partner (JEP)	-
University Partner (TDEP)	-
Social Partner (DE)	-

Shymkent, 2021

Drafters:

Name	Position	Sign
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EP was considered by the Committee on Innovative Learning Technologies and Methodological Support of the Higher school of ChEaBT,
protocol № 7 from 22 02 2021

Chairman of MC (Committee) _____ Aitkulova R.
sign

Considered and recommended for approval at the meeting of Educational and Methodical Council of M. Auezov SKU.
protocol № 5 from 23.02. 2021

Approved by the decision of the Academic Council of the University
protocol № 12 from 05.02 2021

CONTENT

Introduction

1. Scope

Designed for the implementation of magisters training by educational program (here in after - EP) 7M07073-" Petrochemistry" in NJSC on right of economic management "M.Auezov South Kazakhstan University" of RK MES.

2. Regulatory documents

Education Act of the Republic of Kazakhstan (as amended and supplemented on 04/07/2018);

Standard rules for the operation of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan from October 30, 2018 No. 595 (registered with the Ministry of Justice of the Republic of Kazakhstan on October 31, 2018 No. 17657);

State obligatory standards of higher and postgraduate education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan, October 31, 2018 No. 604;

The rules for the organization of educational process on credit technology education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan on April 20, 2011 No. 152 as amended and supplemented of October 12, 2018 No. 563

The sectoral qualifications framework "Petroleum and gas, petroleum processing and petrochemical industries" was approved by the protocol of the Sectoral commission on social partnership and regulation of social and labor relations of the petroleum and gas industry dated March 30, 2017 No. 1-2017

The sectoral qualifications framework “Chemical Production” was approved by the protocol of the session of the sectoral commissions on social partnership and regulation of social and labor relations for mining and smelting, chemical, construction industry and woodworking, light industry and mechanical engineering of August 16, 2016 No. 1.

Professional standard "Pedagogue" (Appendix to the order of the Chairman of the Board of the National Chamber of Entrepreneurs of Kazakhstan "Atameken" No. 133 of June 8, 2017).

3. Educational programs concept

The goal of the educational program is coordinated with the mission of university and is aimed at preparing the intellectual elite of the country with advanced entrepreneurial skills, fluent in three languages, demonstrating conceptual, analytical and logical thinking skills, creative approach in professional activities, being able to work in national and international teams obtaining the lifelong strategy.

The educational program is harmonized with the 7th level of the National Qualifications Framework of the Republic of Kazakhstan, with Dublin descriptors, the 2nd cycle of the Qualification Framework of the European Higher Education Area, also with the 7th level of the European Qualification Framework for Lifelong Education.

The educational program is focused on professional and social order through the formation of professional competencies associated with the necessary types of research, practical and business activities, adjusted to meet the requirements of stakeholders.

The uniqueness of EP 7M07073- "Petrochemistry":

EP is focused on the integration of the educational process, scientific-research and innovation activities, which contributes to the high competitiveness of graduates in the labor market.

EP focuses on the implementation of a master's dissertation commissioned by enterprises using material and intellectual resources, training from leading domestic and foreign specialists, production workers, the opportunity to work in research laboratories of relevant enterprises with unique equipment, participation in international research and educational projects, internships in leading Russian and foreign companies and universities

Program learning outcomes are achieved through the following training events:

- classroom lessons: lectures, seminars, practical and laboratory works are conducted using innovative learning technologies, the latest achievements of science, technology and information systems. Laboratory works are held in the accredited laboratories of the University: Testing regional laboratory of engineering profile "constructional and biochemical materials" and laboratory of physical and chemical methods of analysis "SAPA", on the basis of educational and scientific-industrial complexes of LLP "Ecoshina", LLP "Hillcorporation" et al .;

- extracurricular activities: independent work of the student, including under the guidance of a teacher, individual consultations;

- carrying out pedagogical and research practices, the implementation of master's dissertation based on relevant enterprises;

- scientific- research work of a master student (SRWMS): an independent scientific work of a student, including the implementation of a master's dissertation and research internship at leading Russian and foreign companies and universities.

The university has taken measures to maintain academic integrity and academic freedom, protection from any kind of intolerance and discrimination against students.

The quality of the EP is ensured by the involvement of stakeholders in its development and evaluation, systematic monitoring and review of its content.

4. Entry Requirements

Established according to the Model Rules for admission to studies in educational organizations that implement educational programs of higher and postgraduate education by order MES RK №600 on 31.10.2018

1. Passport of the educational program

1.1 The purpose and objectives of education program by specialty

EP purpose: Preparation of priority demanded workers for scientific, educational, production activities in the field of petrochemistry.

EP objectives:

-provide master's students with in-depth knowledge necessary for managerial, analytical, consulting and teaching activities in the field of chemical engineering;

- provide master's students strong analytical, research and leadership qualities, teamwork skills that allow to solve the problems of increasing the competitiveness of the country in the modern economy;

- provide master's students with skills and lifelong learning skills that will allow them to successfully adapt to changing technologies in the field of petrochemistry throughout their professional careers.

1.2 List of qualifications and positions

The graduate of the educational program 7M07073- "Petrochemistry" is awarded the degree of "Master of Technical Sciences."

Masters in EP can continue training in doctoral studies, occupy the position of managing director, director of development, director of the department, deputy director of the department, chief engineer, chief technologist; chief mechanic; chief manager, research worker, lecturer without presenting requirements for work experience in accordance with the qualification requirements of the "Qualification directory of positions of managers, specialists and other employees" approved by order of the Minister of Labor and Social Protection of the Republic of Kazakhstan dated May 21, 2012 No. 201-ө-m.

1.3 Qualification characteristics of the educational program graduate

1.3.1 Scope of professional activity

The scope of professional activity are enterprises for the production of organic substances, for the processing of petroleum, gas, coal and polymers, elastomers, paints and varnishes, research and project branch institutes, institutions and etc.

1.3.2 Objects of professional activity

The objects of professional activity are equipment, technological processes and industrial systems for the production of substances, materials, products, as well as their management and regulation systems; chemical substances and materials; methods and devices for determining the composition and properties of substances and materials; methods and means of assessing the state of the environment.

1.3.3 Subjects of professional activity

The objects of professional activity are products of basic and fine organic synthesis, polymers, apparatuses and equipment for petrochemical of production and processing of organic substances and materials, various types of raw and auxiliary materials, petroleum, gas, coal, polymers, monomers, elastomers, chemical reagents and reagents, research instruments and equipment, educational and methodical documentation, technical means of education.

1.3.4 Types of professional activity

-scientific and research;

-production and technology;

- organizational and managerial;

-project;

-educational, pedagogical.

2. Learning outcomes for EP

LO1 Analyze and summarize scientific and technical information using information resources, applying knowledge of a foreign language; summarize the results of research work in the form of a dissertation, research article, report.

LO2 Design and implement integrated and interdisciplinary research based on a holistic systemic scientific worldview using knowledge in the field of history and philosophy of science

LO3 Apply knowledge of university psychology and pedagogy in practical activities, plan and carry out scientific and pedagogical work using new information and educational technologies.

LO4 Lead a team of specialists, using the knowledge of university psychology with the use of entrepreneurial skills, making management decisions, showing creativity and logical thinking in non-standard production situations.

LO5 Manage technological processes for the processing of hydrocarbon raw materials, the production of petrochemical products in compliance with life safety and environmental cleanliness, justify the optimal technological mode of production.

LO6 Develop and design new processes and equipment to ensure that products comply with environmental quality standards.

LO7 Independently carry out experimental studies, argue the data obtained, present their developments to a wide audience; commercialize research results.

LO8 Perform technological calculations, develop resource-saving technologies for the processing of hydrocarbon raw materials, carbon black production, surfactants and synthetic detergent, monitor the quality of raw materials and finished products.

LO9 Own principles of selection of catalysts for the processes of deep processing of petroleum raw materials, the development of formulations of paints and polymeric composite materials, perfumes and cosmetics.

LO10 Apply knowledge and skills to analyze problems in interdisciplinary related fields of knowledge; to develop acquired knowledge and skills to a level that allows to study in a doctoral program, to improve their qualifications throughout their lives.

3. COMPETENCES OF EP GRADUATE

3.1 Successful completion of training in EP "Petrochemistry" contributes to the formation of the following competencies of a graduate**:**

- core competencies (CC)
- professioanal competencies (PC).

Core competencies:

(CC1) *language and computer*

- the ability to apply basic communication skills in a foreign language in oral and written forms; the ability to use modern information and digital technologies for analyzing, evaluating and synthesizing new complex ideas necessary for professional activities;

(CC2) *fundamental mathematical, natural science and technical training*

-the ability and readiness to apply, expand and rethink the educational potential acquired during the study of technical disciplines in professional activities and continuing education in doctoral studies;

(CC3) *managerial, economic and entrepreneurial*

-the ability to managerial and entrepreneurial activities, manage the activities of technical services, monitor the results of their work, the state of labor and production discipline; be responsible for the planning, development and results of business processes that may lead to

significant changes or development of the enterprise, manage personnel, demonstrate entrepreneurial skills;

(CC4) *research*

- the ability to conduct a detailed analysis of scientific and technical information in the field of petrochemical industries for the purpose of scientific, patent and marketing support for ongoing research; the ability to summarize the results of research work in the form of scientific publications, to defend their position during the discussion and make professional decisions under conditions of uncertainty and risk;

(CC5) *methodological*

- the ability to analyze and interpret the realities of modern theory and practice based on the methodology of natural science knowledge, to apply new methods of teaching specialized disciplines in teaching activities; develop new laboratory facilities for workshops, update and deepen the knowledge necessary for scientific and educational activities.

Professional competencies:

(PC1) ability to improve petrochemical processes, introduce new advanced technologies into production, develop measures for the integrated use of raw materials, replace scarce materials and find ways to recycle production waste, evaluate their economic efficiency and innovative and technological risks;

(PC2) ability to carry out synthesis, study the structure, properties of materials of chemical engineering, use of modern equipment and instruments in the direction of research;

(PC3) ability to develop and manage the implementation of research and technical projects, new energy and resource-saving ecologically safe technologies with the achievement of maximum production efficiency;

(PC4) ability to quickly and efficiently develop business plans and conduct preliminary marketing research for the commercialization of products of chemical engineering activities.

3.2 Matrix of correlation of EP learning outcomes in general with modules formed by competencies

	LO1	**LO2**	**LO3**	**LO4**	**LO5**	**LO6**	**LO7**	**LO8**	**LO9**	**LO10**
CC1	+		+				+			
CC 2			+			+	+			+
CC 3				+	+	+				+
CC 4	+	+	+			+	+			+
CC 5	+	+	+							+
PC 1				+	+	+	+			
PC2		+				+	+	+		
PC3				+	+	+	+		+	
PC4				+		+	+			+

4. Summary table reflecting the volume assimilated credits of education program modules

Course of Study	Semester	The number of mastered modules	The number of studied disciplines		Number of KZ credits					Total hours	Total credits KZ	The number of	
			BK	KB	Theoretical training	Teaching practice	Research practice	SRWMS	final examination			exam	dif. offset
1	1	5	5	2	29			1		900	30	6	2
	2	5	1	4	23	4		3		900	30	4	2
2	3	4	-	4	21		7	2		900	30	4	2
	4	1	-	-	-			18	12	900	30	-	1
Total		7	6	10	73	4	7	24	12	3600	120	14	7

5. Information about the disciplines

Name of module	CYCLE	HSC/EC	Component name	Short description of discipline	Credits quantity	Formed LO (codes)
Module of scientific - pedagogical training	BD	HSC	History and philosophy of science	Considers the history and philosophy of the natural and technical sciences, modern European science in culture and civilization, the structure of scientific knowledge, philosophical problems of specific sciences. Determines the ways to solve modern actual methodological and philosophical problems of natural and technical sciences, develops critical thinking and logic.	4	LO1, LO2
	BD	HSC	Foreign language (professional)	Allows to develop oral communication skills in a foreign language, intercultural competence, business correspondence exchange skills, master the main types of reading foreign-language original sources, prepare written reports on scientific topics in the specialty: scientific report, presentation, discussions, abstracts and articles on scientific research on foreign language.	4	LO1,LO7
	BD	HSC	Psychology of management	Considers the basic principles of modern psychological science, necessary in the professional work of highly qualified specialists. Forms a scientific and theoretical worldview on fundamental psychological concepts, skills and abilities of psychological researches of a personality, introduces the main methods of experimental - psychological research and areas of psychocorrectional work.	4	LO3, LO4
Methodical foundations of teaching	BD	HSC	Higher school pedagogy	Represents modern paradigms of higher education, the system of higher professional education in Kazakhstan. Considers the methodology of pedagogical science, professional competence of a higher school teacher. Allows seizing the credit system of training, new methods and forms of training in the preparation of future specialists.	4	LO3, LO4
	Ch.D	HSC	Methods of teaching specialized disciplines	Considers the use of competence-based approach in education, technologies of individual, integrated and multimedia learning. Teaches teaching specialized disciplines by analyzing and solving problem situations, drawing up a group project, conducting a role-playing game; provides skills in organizing the educational process. Allows seizing the methodological features specialized disciplines study.	5	LO1,LO, LO3,LO4
	BD	HSC	Pedagogical practice	Develops professional research culture in the field of chemical engineering, as a condition of pedagogical skills and pedagogical creativity, professional pedagogical skills, culture of scientific and pedagogical thinking. Develops skills in developing educational and methodical documentation on major disciplines, preparing and conducting practical and laboratory works in	4	LO1,LO, LO3,LO4

				special disciplines.		
Applied petrochemistry	Ch.D	EC	Methods for the study of organic compounds	Considers the theoretical foundations of UV, IK and YaMR spectroscopy, gas-liquid chromatography and modern methods of analysis of organic compounds; sequence of work in identifying spectra and chromatograms; basic methods of elemental and functional analysis. Instills the skills to solve problems by spectroscopic methods of research.	4	LO1, LO7
			Industrial ecology of hydrocarbon systems	Examines the ecological problems of processing hydrocarbon systems, environmental monitoring, production of hydrocarbon systems with improved environmental characteristics, ecological quality management, industrial and ecological safety in the processing of hydrocarbon systems. Instills the skills of managing technological processes of processing hydrocarbon raw materials, the production of organic substances.		LO1, LO5 LO6, LO8
	Ch.D	EC	Alternative energy and energy saving in petrochemistry	Considers renewable energy sources, their use in the general energy balance of the country and regions; global energy conservation issues in industry; use of secondary energy resources; improve ecological conditions. Instills the skills of practical calculations and selection of power plants based on renewable energy sources.	5	LO1,LO7, LO8
			Carbon black production	Considers the principles of the organization of production of carbon black, its hierarchical structure; production performance evaluation methods; carbon black production methods. Forms the skills of calculating the characteristics of the process of synthesis of carbon black; the choice of a rational scheme for the production of carbon black.		LO5,LO6, LO7,LO8
	Ch.D	EC	Raw material resources of petrochemical synthesis	Considers the main sources of raw materials for petrochemical synthesis processes; technologies for the processes of pyrolysis, oxidation, alkylation, chlorination, condensation on the carbonyl group, intended to produce large-tonnage monomers. Instills the skills of finding ways to improve the existing production of raw materials for petrochemical synthesis.	6	LO5, LO7, LO8
			Modern methods of gas and gas condensate analysis	**Considers modern methods and devices used for the analysis of hydrocarbon, natural gases and gas condensates, commercial products based on them; the main provisions of the theory of measurement of gas processing products. Instills the skills of working on modern devices for measuring the properties of gas industry products.**		LO1, LO7
	Ch.D		Research practice	Instills the skills of designing and implementing complex and interdisciplinary research, analyzing and summarizing scientific and technical information with the involvement of information resources, applying knowledge of a foreign language; performing experimental studies,	7	LO1,LO2, LO7,LO10

				summarizing the results of research in the form of a report, a scientific article.		
Petrochemical processes	Ch.D	EC	Technology paintwork and composite polymeric materials	Considers the range, operational, technological properties and compositions of the main large-tonnage brands of varnishes, paints and composite coatings, the main advantages and disadvantages of the technology. Instills skills of conducting theoretical and experimental research on the development of formulations and the physicochemical properties of paintwork and composite polymeric materials.	6	LO5,LO7, LO9,
			Modern petroleum and gas technology	Considers the scientific basis of the technology of the petroleum and gas complex and trends in the development of technology for exploration, drilling for petroleum and gas. Instills skills of finding and implementing new high-tech solutions in matters of security of processes and objects of the petroleum and gas complex.		LO1, LO6, LO7
	Ch.D	EC	Selected petrochemical heads	Considers modern problems and innovative ways of development of petrochemical industries in Kazakhstan; applied and fundamental research in solving petrochemical problems; use of secondary waste from the petroleum processing industry; modern problems and innovative ways of developing the processing of hydrocarbon raw materials, the production of polymeric materials, plastics, rubbers.	6	LO1, LO5, LO6, LO7, LO8
			Modification of composite materials	Considers the physicochemical principles of modification; methods of modification of polymeric materials; structure formation in polymeric materials; methods of physical and chemical modification; modification by multicomponent systems; surface modification of reinforcing fibers in composite materials. Forms practical skills of obtaining modified composite materials in the laboratory.		LO1, LO7, LO9
Perspective areas of petrochemistry	BD	EC	Technology perfume and cosmetics	Considers the main types of raw materials for the production of perfumery and cosmetic products, approaches to the development of formulations of cosmetic products; technologies for perfumery and cosmetic products. Instills the skills of using scientific knowledge to control the technological processes of the production of perfumes and cosmetics.	5	LO1,LO5, LO7,LO9
			Resource-saving technologies in petroleum products	Considers the characteristics of petroleum products supply systems; sources of pollution of petroleum products during their transportation, storage and distribution; main sources of resource losses of petroleum products; rational methods to prevent resource losses. Instills the skills of evaluating innovation risks when introducing new technologies, equipment and systems.		LO1, LO5 LO7, LO8
	BD	EC	Chemistry and technology of surface-active substance and	Considers the chemical basis of the production of surfactants and synthetic detergents based on them; mechanisms of the synthesis of surfactants, the theory of detergent action. Forms the skills of planning and conducting theoretical and experimental research on the creation of surfactants and	5	LO1,LO7, LO8, LO9

			synthetic detergents	synthetic detergents with given properties.		
			Innovative technologies and equipment for petroleum production and treatment	Considers technological innovations in the four main segments of the petroleum and gas complex: exploration, drilling and injection wells, mining, and organization of well repair. Forms the skills to perform layout, constructive and economic calculations when introducing new technical solutions; selection of equipment taking into account innovative changes.		LO1, LO6, LO7,LO8
Petrochemical synthesis	Ch.D	EC	Calculations of technological processes of petrochemistry	Considers the main indicators of petrochemical processes; methods for calculating expenditure ratios, conversion of raw materials and the yield of target products; the composition of the reaction products; principles of material and heat balances of petrochemical processes. Instills the skills to perform calculations of petrochemical processes.	4	LO1, LO2, LO6, LO8
			Chemical reactors	Considers the theoretical foundations of processes in a chemical reactor; a methodology for studying the interaction of chemical transformation processes and transport phenomena at all scale levels; methodology of reactor selection and calculation of the process in it, the main reaction processes and chemical technology reactors.		LO1, LO2, LO6, LO8
	Ch.D	EC	Petrochemical synthesis technology	Considers new ways of obtaining organic products from petrochemical raw materials. Deepening knowledge of the chemistry and technology of producing initial hydrocarbons for petrochemical syntheses and the most important monomers for synthetic materials. Allows seizing the production technology of oxygen-containing compounds, halogen- and nitro-derivatives, synthetic detergents, rubbers, plastics and fibers.	6	LO1,LO5, LO6,LO7, LO9
			System of diagnostic maintenance of main product pipelines	Examines the general issues of technical diagnostics; failure classification and analysis of factors affecting the quality of equipment operation; technical diagnostics tasks; diagnostic parameters; methods and means of diagnosis. Instills skills of analyzing the technical condition of systems for diagnostic service of main product pipelines, ways to improve them.		LO1,LO7
	BD	EC	Mathematical Modeling of Objects in Petrochemistry	It considers the classification of mathematical models of chemical-technological processes, the development of deterministic, stochastic mathematical models of chemical-technological processes, methods of assessing the adequacy and optimization of mathematical-technological processes. Provides skills in quantitative processing and interpretation of the results of laboratory research and real processes in the oil, petrochemical and gas industries.	5	LO1,LO2, LO7,LO8, LO10
			Technology of Organic Astringent Materials	Study of prospects in the field of development of organic binders; production technologies, properties of binders, waste-free production technologies and integrated use of by-products of other industries-formation of skills for		LO1,LO2, LO7,LO8, LO10

				determining the properties and quality indicators of binders; optimization of technological processes of production and applications of binders.		
Module of Research Work and Final Attestation			Scientific-research work of master student, including internships and the implementation of a master's dissertation (SRWMS)	Forms the skills of analysis and synthesis of scientific and technical literature with the involvement of information resources; summarize the results of research work in the form of a report, dissertation sections, scientific articles, Allows you to acquire the skills of processing and interpretation of the results.	24	LO1,LO2, LO7,LO8, LO10
			Registration and defense of a master's dissertation	Forms skills of generalization and systematization of research results in the form of a master's dissertation, presentation to a wide audience.	12	LO1, LO2, LO6,LO7, LO8,LO9, LO10
Total educational program					**120**	

APPROVAL SHEET

by educational program

7M07173 – «Petrochemistry»

Director of DAI _____ Naukenova A.S.
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