Geology and Oil-gas Business Institute named after K. Turyssov
Department of Chemical and Biochemical Engineering

Education Program

7M07122 - "Chemical engineering of hydrocarbon compounds"

Code and classification of the field of education: **7M07** Engineering, manufacturing and construction areas

Code and classification of areas of study: **7M071** Engineering

Group of educational programs: **M097** - " Chemical engineering and processes "

Уровень по НРК: 7

Уровень по ОРК: 7

Time of study: 1,5

Volume of credits: 90

Almaty 2025

The educational program 7M07122 - "Chemical engineering of hydrocarbon compounds" was approved at the meeting of the Scientific Council of KazNTU named after K.I.Satpayev

Protocol №10 from «06» 03 2025y

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of K.I.Satpayev KazNTU

Protocol №3 from «20» 12 2024y

The educational program 7M07122- "Chemical engineering of hydrocarbon compounds" was developed by the academic committee in the direction 7M071 «Chemical engineering and processes»

Name	Academic degree/ academic	Post	Place of work	
Chairman of the Academic Committee:				
Selenova Bagadat Samatovna	Doctor of Chemical Sciences	Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Teaching staff:				
Mangazbaeva Rauash Amantaevna	Candidate of Chemical Sciences	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Aitkalieva Gulzat Slyashevna	Doctor phD	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Employers				
Seitenova Gaini Zhumagalievna	Candidate of Chemical Sciences, Associate Professor	Head of the Project Office	Petro Gas Chemical Association,	
Students:				
Bogdanova Violetta	-	Student	Kazakh National Research Technical University named after K.I.Satpayev	

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Description of the educational program

The educational program (hereinafter EP) is a set of documents developed 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. The EP takes into account the needs of the regional labor market, the requirements of government agencies and relevant industry requirements.

The production of the main organic and petrochemical synthesis is based on fossil organic raw materials: oil, natural gas, coal. Using modern processes of their processing (cracking, pyrolysis, reforming, rectification, conversion, coking and semi-coking) and various methods of separation of starting materials, the most important compounds are obtained, which are direct raw materials for organic synthesis.

The formation of such a complex of technologically related industries will allow the production of high-tech and science-intensive types of products, which, in turn, will cause the accelerated development of other sectors of the real sector of the economy of the Republic of Kazakhstan. Kazakhstan, within the framework of its innovation and industrial policy, covers a wide range of petrochemical development, which will undoubtedly accelerate the accelerated development of the economy of the Republic of Kazakhstan in the future.

The EP is based on the state educational standard for higher professional education in the relevant field.

The EP defines the program educational goals, the learning outcomes of undergraduates, the necessary conditions, content and technologies for the implementation of the educational process, the assessment and analysis of the quality of students during training and after graduation.

The EP includes the curriculum, the content of disciplines, learning outcomes and other materials to ensure quality education for undergraduates.

2. Purpose and objectives of the educational program

EP goals:

- formation on the basis of the scientific school of the national research university of general cultural, professional and special competencies that allow the graduate to successfully work in the field of organic and petrochemical synthesis enterprises and be competitive in the labor market;
- development of undergraduates' personal qualities such as creativity, responsibility, tolerance, the desire for self-development and disclosure of their creative potential;

- development of research qualities, the ability to plan, set up, perform and generalize experimental research according to the chosen program, the formation

of a critical understanding of the existing fundamental scientific theories and concepts, and the explanation of the results obtained from the standpoint of modern chemical science and technology;

- development and implementation of active learning methods for the formation of a creative, innovative approach to understanding professional activities, the development of independent thinking and the ability to make optimal decisions in a particular situation;

- development of educational and methodological documentation, methods for monitoring the knowledge of students and multimedia materials for the educational process.

Tasks of the OP:

· improvement and implementation of the educational process using advanced teaching methods;

· involvement in the educational process of high-class scientific personnel of international level and specialists in the production sector;

· use of modern equipment and instruments to improve the efficiency and level of scientific research;
· development of international cooperation for the implementation of joint scientific projects and master's programs for double-diploma education.

3. Requirements for evaluating the learning outcomes of an educational program

The educational program has been developed in accordance with the State mandatory Standards of Higher and Postgraduate Education, approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of Regulatory Legal Acts under No. 28916) and reflects the learning outcomes on the basis of which curricula are developed (working curricula, individual curricula of students) and working curricula in disciplines (syllabuses).

Formed learning outcomes: applies knowledge of natural science, socio-economic and profile disciplines of chemical technology to solve practical and professional tasks of the technological industry.

Evaluation of learning outcomes is carried out according to the developed test tasks within the educational program in accordance with the requirements of the state mandatory standard of higher and postgraduate education.

When evaluating learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate their knowledge, skills and abilities. To use modern information technologies for the collection, processing and dissemination of scientific information in the field of production of organic substances, processing of oil, gas, coal and polymers, elastomers, paints and varnishes.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	7M07 Engineering, manufacturing and construction areas
2	Code and classification of areas of study	7M071 Engineering and Engineering
3	Group of educational programs	M097 - "Chemical Engineering and Processes"
4	Name of the educational program	7M07122 - "Chemical engineering of hydrocarbon compounds"
5	Brief description of the educational program	The EP regulates the educational process of training specialists in the field of chemical engineering in the field of organic and petrochemical synthesis enterprises. The program is built taking into account the possibility of providing the undergraduate with the choice of the appropriate educational trajectory, containing their own individual competencies, reflecting the specifics of a particular specialization within the framework of a single educational direction 7M071 - Engineering and Engineering.
6	Purpose of the OP	The purpose of the EP is to train highly qualified and competitive specialists in the labor market, focused on solving the problems of innovative development of the most important areas in the field of organic and petrochemical industries, with creativity, formed critical understanding of fundamental scientific theories and concepts and the ability to interpret the results obtained from the standpoint of modern chemical science and technology .
7	OP type new	OP type new
8	The NRK level	7
9	The ORK level	7
10	Distinctive features of the OP	The EP was developed taking into account the Atlas of new professions and competencies of Kazakhstan in the field of oil refining and petrochemistry.
11	List of competencies of the educational program:	KK1.Communication - Fluent monolingual oral, written and communication skills - The ability to use communicative communication in various situations KK 2. Basic literacy in natural science disciplines - basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science KK3.General engineering competencies - basic general engineering skills and knowledge, the ability to solve general engineering tasks and problems KK4.Professional competencies - a wide range of theoretical and practical knowledge in the professional field; - the ability to carry out the technological process in accordance with the regulations and use technical means to measure the main parameters of the technological process, the composition and properties of raw materials and finished products; KK5. Engineering and computer competencies

		- basic skills of using computer programs and software systems to solve general engineering tasks KK6.Engineering and working competencies - skills and abilities of using technical means and experimental devices to solve general engineering tasks KK7. Socio-economic competencies - Critical understanding and cognitive ability to reason on contemporary social and economic issues KK8. Specially-professional competencies for the perception of information, setting goals and choosing ways to achieve it; – the ability to independently organize the work of performers, find and make management decisions in the field of labor organization and implementation of environmental measures; – knowledge of the principles of management, control and correction of activities in the context of teamwork, improving managerial and executive professionalism.
12	Learning outcomes of the educational program:	PO1 Apply knowledge of the basic laws of natural sciences (chemistry, physics) in solving professional problems in the field of chemical and petrochemical engineering.; RO2 Demonstrate high professional qualities and ethics when interacting with various stakeholders PO3 Use the acquired knowledge in the development, design and operation of technological processes PO4 Use physical and chemical research methods, computer and information technologies; process and analyze information to calculate the technological parameters of equipment, indicators of technological processes in the field of petrochemical engineering PO5 Use physical and chemical research methods, computer and information technologies; process and analyze information to calculate the technological parameters of equipment, indicators of technological processes in the field of petrochemical engineering RO6 Speak a foreign language at a professional level, allowing you to conduct scientific research in an international context and to teach special disciplines in universities PO7 Apply alternative, technical, technologically safe solutions in the area under study. Analyze problems in the field of engineering and find ways to solve them, solve engineering problems of production design RO8 Apply scientific methods of cognition in professional activities, critically analyze existing concepts, theories and approaches to the study of processes and phenomena
13	Form of study	full-time
14	Training period	1,5 years
15	Volume of loans	90
16	Languages of instruction	Kazakh, Russian, English
17	Awarded Academic Degree	Master of Engineering
18	Developer(s) and authors:	Selenova B.S, Mangazbayeva R.A, Aitkaliyeva G.S

4.2. The relationship between the achievability of the formed learning outcomes in the educational program and academic disciplines

№	Name of discipline	Brief description of discipline	Number of credits	PO1	Formed learning outcomes (codes)						
					PO2	PO3	PO4	PO5	PO6	PO7	PO8
Basic of disciplinles University component											
1	English (professional)	In the process of learning, students acquire knowledge of a foreign language, including the possession of specialized vocabulary, necessary for the implementation of effective oral and written communications in a foreign language in their professional activities. Practical tasks and methods for developing the required language skills in the learning process include: case method and role-playing games, dialogues, discussions, presentations, listening tasks, work in pairs or groups, various written tasks, grammar tasks and explanations.	2						V		
2	Psychology of management	To acquire skills in making strategic and managerial decisions, taking into account the psychological characteristics of the individual and the team. Content: the modern role and content of psychological aspects in management activities, methods for improving psychological literacy, the composition and structure of management activities, both at the local and foreign levels, the psychological feature of modern managers.	2		V						
3	Management	To form a scientific understanding of management as a type of professional activity. Contents: Mastering the general theoretical principles of managing socio-economic	2		V						

		systems; acquiring skills and abilities in practical problem-solving of managerial issues; studying global management practices and the specificities of Kazakhstani management; training in solving practical issues related to managing various aspects of organizational activities.									
Basic of disciplinles Celection component											
4	Chemical reagents in the processes of oil preparation and oil production	The course outlines the main provisions of oilfield chemistry related to the extraction, transportation and primary preparation of oil; an analysis of the main problems arising during the extraction and transportation of crude oil, ways and methods of solving these problems is given. Purpose, characteristics and classification of drilling fluids: water-based and oil-based solutions, polysaccharide-based and polymer-based solutions. Practical recommendations on the selection of the necessary reagents of oilfield chemistry.	4				**v**			**v**	
5	Chemmotology petroleum products	The course is devoted to the study of scientific and applied foundations for the efficient use of fuels, lubricants and technical fluids in various types of equipment, necessary for a deeper assimilation of systems for assessing the quality of petroleum products, methods for regulating the composition of motor fuels and lubricants during their production, transportation and storage.	4								**v**
6	Oil products himmotology	This discipline consists in studying the scientific and applied foundations for assessing the use of fuel, lubricants and chemical liquids in various types of appropriate techniques for a	5	V			V				

		more in-depth application of system requirements for the quality of oil production products. As a result of training: knowledge of regulatory methods in the production, transportation and storage of motor fuels and lubricants; ability to develop design solutions on the chemmotology of petroleum products.									
7	Mechanisms of organic reactions	The goal is to form the ability to understand the mechanisms of various organic reactions. As a result of training: to know the general classification of mechanisms, the concepts of the transition state; the stages of studying the mechanisms of reactions: to calculate the material balance, kinetics, stereochemical correlations, to understand isotopic and structural labels, the influence of substituents, solvents, catalysts, to search for unstable intermediates; to carry out kinetic and thermodynamic control of reactions; to be able to calculate the thermodynamic parameters of reactions.	5	V							**v**
8	Industrial Organic Chemistry	The goal is to form the ability to understand the characteristics and features of the industry of basic organic synthesis, to understand the relationship between basic organic synthesis and specialized (branch) synthesis. As a result of training: to understand the raw material base of industrial organic chemistry, the main chemical processes of industrial organic chemistry; to be able to create design solutions for processing raw materials to create products of industrial organic chemistry.	5	v							v
The cycle of profile disciplines											

The university component											
9	Heavy oil refining technology,	As part of the course, undergraduates will learn to form the ability to understand the methodology of scientific research in the field of heavy oil refining technology. As a result of training: to be able to choose scientific methods for processing heavy high-viscosity oils, natural petroleum bitumen; to apply special methods of extraction and processing of heavy high-viscosity oils, natural petroleum bitumen; to use the data of physico-chemical characteristics of heavy raw materials to obtain from them not only fuels and oils, but also metals.,	5							**v**	**v**
10	Biofuel technology	The aim is to develop the ability to analyse modern issues and challenges of biofuel production technology. Modern methods and stages of biofuel processing and the prospects of the industry development will be considered; selection of raw material sources for biofuel production, design of biofuel production; application of methods of environmental assessment of biofuel production and use.	5				V				**v**
11	Technology of heterolytic and homolytic processes	The discipline includes studies in the scientific and applied foundations of the creation of effective catalytic methods for the study of hydrocarbons of petroleum raw materials in industry. As a result of training: understanding the nature of the intermediate interaction of the catalytic reaction system, the nature of chemical deactivation of catalysts; be able to create design solutions based on an understanding of the modern theory of heterogeneous catalysis	5								**v**

		and technologies of large-capacity catalytic processes of oil refining and petrochemistry.									
12	Industrial reactors for large-capacity chemical production	The discipline studies the understanding of technology and measurement, the methodology of calculating the technological process and toxicity. As a result of the training: the master's student will master the thermodynamic and kinetic foundations of chemical technologies, the theoretical basis of chemical technologies, hardware and technological design of chemical technology processes; will be able to organize and manage the technological process; carry out technological and structural calculations of chemical plants and reactors; work with regulatory and technical documents.	5			v		v		**v**	
13	New technologies of materials and products	As part of the course, undergraduates will master extensive research in the field of nanotechnology designed to create nanostructured materials for structural and functional purposes. As a result of training: knowledge of methods of obtaining and research, and the properties of the prospects for the use of new materials; to consider the prospects for the development of new technologies on a global scale, as well as the social and social consequences of their introduction into production.	5							**v**	**v**
14	Environmental aspects of petrochemical production	The purpose of studying the discipline is to ensure the environmental safety of the surrounding region, the use of advanced and safe technologies and equipment in order to avoid their destabilizing impact on the environment. Summary: Ecological problems of hydrocarbon systems processing. Basic	4				**v**				

		concepts of ecology of hydrocarbon systems processing. Explosions and fires, their forecasting. Ways to manage fire and explosion safety in the processing of hydrocarbon systems. Monitoring of the environment in the processing of hydrocarbon systems. Water basin monitoring. Pollution and monitoring of the lithosphere. Biological monitoring of the environment. Development of automated monitoring systems for oil refining and petrochemical enterprises. Expected results: the formation of the students' task of ecology for the processing of hydrocarbon systems, the main provisions of the environmental aspects of the production and use of petroleum products, the development of hardware and technological schemes for managing the quality of the environment. The undergraduate should know: environmental problems and basic concepts of hydrocarbon systems processing, features of the environmental impact of combustion products of hydrocarbon systems.									
15	Problems of waste disposal of petrochemical industries	The aim is to form the ability to analyse the actual problems of petroleum sludge utilisation and processing. There will be considered physico-chemical and biological methods of oil sludge utilisation and its protection; use of oil sludge and its products as secondary material resources; creation of project solutions for the use of petrochemical waste.	5			v	v	**v**			
16	Industrial catalysis and catalysts in oil refining	Undergraduates will master the understanding of the features of heterogeneous catalysis, large-capacity catalytic processes, various reactions of receptors of petroleum products and the	5	v							v

		inclusion of food catalysts. As a result of the training: they will gain knowledge of the production of catalysts; apply methods of studying catalysts, determine the activity, specific surface area, structure and mechanical strength of catalysts; the property of being observed in equilibrium, kinetics on a homogeneous surface, diffusion and macrokinetics, the influence of perception of the medium on the kinetics of the process.									
17	Modern problems of quality control of chemical products	The discipline studies production and the role of control in ensuring high quality of chemical products, quality control of chemical products in accordance with regulatory documentation. As a result of the training, students will learn: the basics of chemical and physico-chemical quality control of various types of chemical products and hydrocarbon raw materials; methods and features of product quality control, standardization of products and processes; will have an idea of the methods of ownership and control of food purity.	5							V	**v**
18	Industrial practice	During the internship, undergraduates get acquainted with the latest theoretical, methodological and technological achievements of domestic and foreign Science, modern methods of scientific research, processing and interpretation of experimental data. At the same time, undergraduates learn to be responsible for the quality of research and scientific reliability of the results obtained, professionally design, present and report the results of research work, performing experimental research on the topic of a master's thesis using modern instrumental	4					V			V

		methods and computational tools.									

5. Curriculum of the educational program

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	M097 - "Chemical engineering and processes"
Educational program	7M07122 - "Hydrocarbon engineering"
The awarded academic degree	Master of engineering and technology
Form and duration of study	full time (professional track) - 1,5 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters			Prerequisites
									1 course		2 course	
									1 sem	2 sem	3 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)												
CYCLE OF BASIC DISCIPLINES (BD)												
M-1. Module of basic training (university component)												
LNG212	Foreign language (professional)		BD, UC	2	60	0/0/30	30	E		2		
MNG726	Management		BD, UC	2	60	15/0/15	30	E		2		
HUM211	Psychology of management		BD, UC	2	60	15/0/15	30	E		2		
CHE799	Chemmotology petroleum products	1	BD, CCH	4	120	30/0/15	75	E		4		
CHE798	Chemical reagents in the processes of oil preparation and oil production	1	BD, CCH	4	120	30/0/15	75	E		4		
CHE779	Mechanisms of organic reactions	2	BD, CCH	5	150	30/0/15	105	E		5		
CHE778	Industrial Organic Chemistry	2	BD, CCH	5	150	30/0/15	105	E		5		
CYCLE OF PROFILE DISCIPLINES (PD)												
M-2. Module of professional activity (university component, component of choice)												
CHE773	Problems of waste disposal of petrochemical industries		PD, UC	5	150	30/0/15	105	E	5			
CHE774	Biofuel technology		PD, UC	5	150	30/0/15	105	E	5			
CHE772	Heavy oil refining technology		PD, UC	5	150	30/0/15	105	E	5			
CHE769	Modern problems of quality control of chemical products		PD, UC	5	150	30/0/15	105	E	5			
CHE775	Industrial catalysis and catalysts in oil refining		PD, UC	5	150	30/0/15	105	E	5			
CHE766	Industrial reactors for large-capacity chemical production		PD, UC	5	150	30/0/15	105	E		5		
CHE767	Technology of heterolytic and homolytic processes		PD, UC	5	150	30/0/15	105	E		5		
BIO289	New technologies of materials and products		PD, UC	5	150	30/0/15	105	E		5		
HBI218	Environmental aspects of petrochemical production		PD, UC	4	120	30/0/15	75	E			4	
M-3. Practice-oriented module												
AAP248	Internship		PD, UC	5				R	5			
M-4. Experimental research module												
AAP249	Experimental research work of a master student, including an internship and the implementation of a master's project		ERWMS	18				R			18	
M-5. Module of final attestation												
ECA213	Design and defense of the master's project		FA	8							8	
Total based on UNIVERSITY:									30	30	30	
									60		**30**	

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	6	9	15
PD	Cycle of profile disciplines	0	49	0	49
Total for theoretical training:		**0**	**55**	**9**	**64**
RWMS	Research Work of Master's Student				0

ERWMS	Experimental Research Work of Master's Student				18
FA	Final attestation				8
TOTAL:					**90**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 28.11.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. Б.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
Director - Geology and Oil-gas Business Institute named after K. Turyssov	Auyelkhan Y. .
Department Chair - Chemical and biochemical engineering	Mangazbayeva R. A.
Representative of the Academic Committee from Employers ____Acknowledged____	Seytenova G. Z.