



**NJSC "Kazakh National Research Technical University named after  
K. Satpayev"**

**Institute of Geology and Oil and Gas Business  
Department of chemical and biochemical engineering**

## **EDUCATIONAL PROGRAM**

**«CHEMICAL TECHNOLOGY OF  
PETROLEUM AND GAS CHEMICAL PRODUCTS»**

**The Bachelor of Technics and Technologies  
In Engineering**

1st edition  
in accordance with the State Educational Standard of Higher Education 2018

**Almaty 2021**

The program was made up and signed by:

**Satbayev University:**

1. The Head of the department \_\_\_\_\_ Amitova A.A.
2. The director of the GaOaM institute \_\_\_\_\_ Syzdykov A.Kh.
3. The professor of the department, D.Sc. \_\_\_\_\_ Selenova B.S.
4. Assistant Professor, C.Sc., \_\_\_\_\_ Kerimkulova A.Zh.



From the employer:

General manager of the ALE "Association of Producers and Consumers of Petrochemical Products" Tolkimbaev G.A.

Approved on a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K. Satpayev. Protocol No. 11 from -14.06.2021

**Qualification:**

Level 6 of the National Qualifications Framework:

6B07 Engineering, manufacturing and construction industries:

6B071 Engineering and Engineering (0710)

Professional competence 6B071: Organization and management of technological processes in the petrochemical industry; quality control of raw materials, materials and finished products; assessment of the economic efficiency of technological processes, innovation and technological risks when introducing new technologies.

## **1. BRIEF DESCRIPTION OF THE PROGRAM**

### **1.1 The purpose of developing an 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 state bodies and the corresponding industry requirements. The oil and gas industry is one of the foundations of the economy of Kazakhstan. It includes a set of interrelated processes and industries from geological exploration to oil and gas refining and sales. In this chain, the process of oil and gas processing stands apart, since as we move along the technological chain, there is a rapid increase in added value (petrochemical products of high conversions).

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

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

EP includes the curriculum, discipline content and learning outcomes and other materials to ensure quality education for students.

The purpose of the development of the EP “Chemical Technology of Petrochemical Products” is to help students, teachers and industry experts understand the structure of the educational process and demonstrate how the curriculum and course content contribute to the formation of the necessary core competencies after graduation by students. Also, an important goal of the EP is to establish a common basis for the feasibility and necessity of the Chemical Technology of Petrochemical Products training program for all stakeholders, including government, government agencies, the oil and gas industry, universities, parents and students, and the community.

### **1.2 Normative documents for the development of an educational program**

The regulatory legal framework for the development of this educational program is:

- The Law of the Republic of Kazakhstan "On Education" with amendments and additions within the framework of legislative changes to increase the independence and autonomy of universities from 04.07.18, No. 171-VI.
- The Law of the Republic of Kazakhstan "On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan Concerning the Expansion

of Academic and Administrative Independence of Higher Education Institutions" dated 04.07.18, No. 171-VI;

- Order of the Minister of Education and Science of the Republic of Kazakhstan dated 30.10.18 No. 595 "On approval of the Standard Rules for the Activities of Educational Organizations of the appropriate types";

- State compulsory standard of higher education (Appendix 7 to the order of the Minister of Education and Science of the Republic of Kazakhstan dated 31.10.18, No. 604;

- Order of the Minister of Education and Science of the Republic of Kazakhstan dated 20.01.15, No. 19 On approval of the Rules for the transfer and restoration of students by types of educational organizations, with amendments and additions by order No. 601 of 31.10.18;

- Working curriculum of the educational program "Chemical technology of petrochemical products" for 2021-2022, approved by the rector of the Kazakh National Research Technical University named after K.I. Satpayev;

- Documents of the QMS system (Quality Management System) on the organization of the educational process at the Kazakh National Research Technical University named after K.I. Satpayev.

### **1.3 Characteristics of professional activity**

The area of professional activity of the graduate of this program in the direction of training 6B071 - Engineering and Engineering includes methods, methods and means of obtaining petrochemical products and polymers from hydrocarbon raw materials of the Republic of Kazakhstan using chemical, physical and physicochemical processes.

Objects of professional activity: oil and gas chemical clusters consisting of oil and gas processing and oil and gas chemical industries, enterprises for the production and processing of polymers, research centers, engineering, design and construction companies, consulting organizations that supply the cluster enterprises with the latest technological developments.

Subjects of professional activity: Physical and chemical phenomena and processes underlying the preparation of well products and oil and gas processing, petrochemical products, technological equipment and apparatus for physical and chemical processes of petrochemical clusters, various types of raw materials and auxiliary materials and substances, chemical reagents, etc. reagents.

Professional activities: Bachelor who graduated from the EP "Chemical technology of petrochemical products" in the direction of training 6B071 - Engineering and engineering is preparing for the following professional activities:

- production and technological;
- organizational and managerial,

- research;
- design and engineering.

#### **1.4 Goals and objectives of the educational program**

The mission of the educational program "Chemical technology of petrochemical products" of the first cycle of the direction "6B071 Engineering and optimization and modernization of oil and gas processing, oil and gas chemical industries and enterprises for the production and processing of polymers, materials and devices, which determine the innovative development of scientific and technological progress and an increase in the standard of living of society.

In accordance with this mission, the main objectives of this EP are:

- social, humanitarian and professional training of bachelors in the field of chemical engineering in accordance with the development of science and production, as well as with the needs of petrochemical clusters of Kazakhstan, national research centers, master's and doctoral studies of higher educational institutions;

- training of bachelors - technologists who know the raw material base, methods of analytical control of the quality of raw materials and commercial products, production technologies and the area of consumption of petrochemical products and materials, having fundamental training in physics, mathematics, chemistry, physical and chemical foundations of technologies for obtaining the most important classes of organic substances, production of chemical reagents (demulsifiers, surfactants, polymers) used in the processes of extraction, preparation and transportation of hydrocarbons.

- providing knowledge, skills and abilities that allow to analyze problems in the field of chemical engineering and find ways to solve them, solve engineering problems of designing petrochemical plants, carry out research work in the field of synthesis and study of the properties of new chemical compounds and materials using information technologies and methods mathematical planning of the experiment.

- preparation of students for professional activity in the conditions of existing production, the formation of skills and abilities to maintain the required level of labor and industrial discipline; to conduct a technical and economic analysis of production; on the adoption and implementation of management decisions in the context of different opinions.

Objectives of the educational program:

- Studying the cycle of general education disciplines to ensure social and humanitarian education based on the laws of the socio-economic development of society, history, modern information technologies, the state language, foreign and Russian languages.



- Studying the cycle of basic disciplines to provide knowledge of natural science, general technical and economic disciplines, as the foundation of professional education.
- Studying a cycle of major disciplines for the formation of theoretical knowledge, practical skills and abilities in the field of chemical engineering and engineering.
- Study of disciplines that form knowledge, skills and abilities of planning and organizing research, designing technological schemes, equipment and apparatus, including using modern computer technologies and programs.
- Acquaintance with chemical-technological processes and equipment of oil and gas chemical complexes during the period of production practices.
- Acquisition of skills and abilities of modern analytical quality control of raw materials and commercial products.

**Contact Information**

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**ACADEMIC REQUIREMENTS**

**Requirements for applicants**

Admission to a university is carried out according to the applications of an applicant who completed secondary, secondary specialized education in full on a competitive basis in accordance with the points of the certificate issued based on the results of a single national test with a minimum score of at least 65 points.

Special requirements for admission to the program apply to graduates of 12-year schools, colleges, applied bachelor's programs, NIS, etc. Such applicants must pass diagnostic testing in English, mathematics, physics and special disciplines.

Table 1 - Rules for credit transfer for accelerated (reduced) studies based on 12-year, secondary, secondary technical and higher education

Code	Competence's type	Description of competence	Result of competence	Responsible
GENERAL (implies full training with possible additional, depending on the level of knowledge)				
G	Communicativ	- Fluent	Complete	Departme

1	eness	monolingual oral, written and communic ative skills - ability is not fluent communic ation with second language -Ability use in different situations communic ative communic ation - there are basics academic writing in native language - diagnostic test to the language level	4-year training with developmen t at least 240 academic credits (of which 120 contact classroom academic credits) with possible recalculatio n loans for the second language where students has a level advanced. Language level determined by surrender diagnostic test	nt Kazakh and Russian language, Chair of english language
2	G Mathematical literacy	Basic Mathemati cal thinking on communic ation level - ability solve situational problems at the base	Full 4-year training with at least mastery 240 academic credits (of which 120 contact classroom academic credits). At	Departm ent of Math

		mathematical apparatus of algebra and began mathematical analysis - diagnostic test for mathematical literacy in algebra	positive surrender diagnostic test level Mathematics 1, for negative - Algebra level and start analysis	
3	G Basic literacy in naturally-scientific disciplines	- basic understanding scientific picture of the world with understanding the essence basic laws of science - understanding of basic hypotheses, laws, methods, formulation conclusion and assessment errors	Complete 4-year training with development at least 240 academic credits (of which 120 contact classroom academic credits). At positive surrender diagnostic test level Physics 1, General chemistry, at negative - Beginning level Physics and Basic fundamentals of chemistry	Chairs in directions natural sciences



SPECIFIC (implies reduced training due to credit transfer depending on the level knowledge on competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic directions)					
1	S	Communicativ eness	- Fluent bilingual oral, written and communic ative skills - ability is not fluent communic ation with the third tongue - writing skills different styles of text and genre - deep skills understand ing and interpretati on of own work a certain level difficulty (essay) - basic aesthetic and theoretical literacy as a condition full- fledged perception ,	Full credit credits by language (Kazakh and Russian)	Departme nt of Kazakh and Russian language

		interpretati ons original text		
2	S Mathematical literacy	- Special mathemati cal thinking with using induction and deduction, generalizat ions and concretizat ion, analysis and synthesis, classificati on and systematiz ation, abstraction and analogies - ability formulate, justify and prove positions - application of common mathemati cal concepts, formulas and expanded spatial perception for	Credit transfer by discipline Maths (Calculus) I	Departme nt of Math

		mathematical problems - full understanding fundamentals of mathematical analysis		
3	Special literacy in naturally-scientific disciplines (Physics chemistry, Biology and Geography)	- Broad scientific perception of the world, presupposing deep understanding of natural phenomena - critical perception for understanding scientific environmental phenomena in the world - cognitive ability to formulate scientific understanding of the forms of the existence of matter, its interactions and manifestations in nature	Credit transfer by Physics I, General chemistry, General biology, Introduction to geology, Introduction to geodesy; Training practice, etc	Chairs in directions of natural sciences
4	English	- readiness for further	Credit transfer	English Department

		self-study on English in different areas knowledge - readiness for gaining experience in project and research work using of English language	of English language above level academic before professional (up to 15 credits)	
5	S Computer skills	- Basic skills programm ing on one modern language - use of software and applicatio ns for training in various disciplines -the availability of a worldwide certificate standard about the language level	Credit transfer by discipline Introductio n to information al communica tion technologie s, Information al communica tion technologie s	Departme nt of program engineerin g
6	S Social Humanities competence	- understanding and awareness	Credit transfer according	Departm ent of public

	and behavior	responsibil ity every citizen for developme nt of the country and the world - Ability discuss ethical and moral aspects in society, culture and scie nce	to the Modern history of Kazakhstan (with the exception of state exam)	disciplin es
		- Critical understand ing and capacity for polemics to debate on modern scientific hypotheses and theories	Credit transfer in philosophy and other humanitarian discipline s	
PROFESSIONAL (implies reduced training due to credit transfer depending on the level of knowledge on competencies for graduates of colleges, AV schools, universities, including humanitarian and economic areas)				
1	P Professional competence	critical perception and deep understanding of professional competencies at level 5 or 6 - Ability to discuss and	Recalculati on of credits in basic professional disciplines, including an introduction to the specialty, the structure and	Graduati ng department

		argue on professional issues within the framework of the mastered program	design of systems and machines by industry, after-sales service of machines by industry, educational and training practice	
2	P General engineering competencies	- basic general engineering skills and knowledge, the ability to solve general engineering problems and problems - be able to use software packages for processing experimental data, solving systems of algebraic and differential equations	Credit transfer for general engineering disciplines (Engineering graphics, descriptive geometry, fundamentals of mechanics, fundamentals of hydrodynamics, fundamentals of electrical engineering, fundamentals of microelectronics, fundamentals of thermodynamics, etc.)	Graduating department
3	P Computer engineering competence	- basic skills of using computer programs and soft systems for solving general engineering problems	Credit transfer for the following computer graphics disciplines, CAD fundamentals, CAE fundamentals, etc.	Graduating department
P	Engineering	- skills and	Credit	Graduating



4	and working competencies	abilities to use technical means and experimental devices for solving general engineering problems	transfer for academic disciplines of the experimental direction: laboratory or analytical chemistry, laboratory physics, mineralogy, etc.	ng department
5	P Socio-economic competencies	Critical understanding and cognitive ability to reason on contemporary social and economic issues - Basic understanding of the economic assessment of objects of study and the profitability of industry projects	Recalculation of credits in socio-humanitarian and technical-economic disciplines in the offset of the elective cycle	Graduating department

The university may refuse to transfer credits if a low diagnostic level is confirmed or the final grades in completed disciplines were below A and B.

## 2.2 Requirements for Completion and Diploma

Description of the generally obligatory standard requirements for graduating from a university and assigning an academic bachelor's degree: mastering at least 240 academic credits of theoretical training and a final thesis or a state exam in the specialty.

Special requirements for graduation under this program:




**Full-time form of education**

**Terms of study:** from 4 to 7 years.


**Language of instruction:** Kazakh, Russian, English (more than 50%)

## 2.3 Working curriculum of the educational program "Chemical technology of petrochemical products"



**SATBAYEV  
UNIVERSITY**

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN  
NUSC «KAZAKH NATIONAL RESEARCH UNIVERSITY named after K.I. SATBAYEV»



Official stamp of the Ministry of Education and Science of the Republic of Kazakhstan, dated 2021-2022, for the admission of students to the Faculty of Chemistry and Chemical Engineering, Department of Chemical Engineering and Processes.

**MAJOR CURRICULUM**  
for 2021-2022 academic year admission  
Educational program: 6807117 – "Chemical technology of petrochemical products"  
Group of Educational program 6095 – «Chemical engineering and processes»

Full-time study

Study duration: 4 years

Academic degree: bachelor of natural sciences

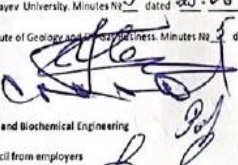
Year of study	Code	Name of discipline	Cycle	Total volume in credits	Total hours	Practical hours (in %)	Thesis	Code	Name of discipline	Cycle	Total volume in credits	Total hours	Practical hours (in %)	Thesis	Code			
1	ENG108	English	0	5	150	0/0/3	105	diag. test	ENG108	English	0	5	150	0/0/3	105	ENG108		
	ENG104	Kazakh (Russian) language	0	5	150	0/0/3	105	diag. test	ENG104	Kazakh (Russian) language	0	5	150	0/0/3	105	ENG104		
	PHYS11	Physics I	6	5	150	1/1/3	105		PHYS11	Physics I	6	5	150	1/1/3	105	PHYS11		
	MAT101	Mathematics I	6	5	150	1/0/2	105		MAT101	Mathematics I	6	5	150	1/0/2	105	MAT101		
	GRI122	Engineering and computer graphics	6	5	150	1/1/3	105		GRI122	Engineering and computer graphics	6	5	150	1/1/3	105	GRI122		
	HUM125	Culturalology	0	2	60	1/0/0	45		HUM125	Culturalology	0	2	60	1/0/0	45	HUM125		
	PE1201	Physical education I	0	2	60	0/0/2	30		PE1201	Physical education I	0	2	60	0/0/2	30	PE1201		
	Total:			29	840		18		Total:			31	870		19			
	2	HUM132	Philosophy	0	5	150	1/0/2	105	no	CSE477	Informatics and Communication technology	0	5	150	2/0/0	105	no	
		HUM122	Psychology	0	2	60	1/0/0	45	no	HUM122	Sociology	0	2	60	1/0/0	45	no	
MNG187		Fundamentals of Entrepreneurship, Leadership and Anti-corruption culture	0	3	90	1/0/3	60	no	CH452	Ecology and sustainable development	0	2	60	1/0/0	45	no		
CH453		Life safety	0	2	60	1/0/0	45	no	CH459	Organic Chemistry II	6	5	150	2/1/2	105	CH459		
CH454		General Chemistry	6	5	150	1/1/3	105	BIO114	CH450	General chemical technology	6	5	150	2/1/0	105	CH450		
CH456		Field preparation of oil and gas	6	5	150	2/0/3	105	BIO114	CH450	Collection, preparation and transportation of hydrocarbon gas	6	5	150	2/0/1	105	CH450		
CH455		Organic Chemistry I	6	5	150	1/1/3	105	BIO114	CH457	Physical chemistry	6	5	150	1/1/3	105	CH457		
PE1203		Physical education III	0	2	60	0/0/2	30		PE1204	Physical education IV	0	2	60	0/0/2	30			
Total:			29	840		18		Total:			31	870		19				
3		CH471	Technological processes of oil production intensification	6	5	150	2/0/3	105	CH471	Storage of hydrocarbon raw materials	6	4	120	1/0/1	80	CH471		
	CH475	Fundamentals of petrochemical synthesis	6	5	150	2/0/3	105	CH475	CAD Chemical and Biological Engineering II	6	5	150	0/1/2	105	CH468			
	CH467	Hardware design of oil and gas processing processes I	6	5	150	2/0/3	105	CH470	Hardware design of oil and gas processing processes II	6	5	150	2/0/3	105	CH467			
	CH468	CAD Chemical and Biological Engineering I	6	5	150	0/1/2	105	CH470	Technology of organic and petrochemical industries	6	5	150	2/0/3	105	CH468			
	CH472	Fundamentals of physical and chemical analysis of oil refining processes and petrochemistry	6	5	150	2/0/3	105	CH471	Process Design	6	5	150	2/0/3	105	CH469			
	CH473	Technology of primary processing of oil and gas I	6	5	150	2/0/3	105	CH475	Technology of primary processing of oil and gas II	6	5	150	2/0/3	105	CH471			
	Total:			30	840		18		Total:			29	840		18			
	4	CH474	Chemical processing of hydrocarbon gas	6	5	150	2/0/3	105	CH475	CH468	Technology of production and processing of polymers	6	4	120	1/0/1	80	CH475	
		CH469	Catalysis and catalytic processes of petrochemistry	6	5	150	2/0/3	105	CH477	Environmental aspects of petrochemical production	6	4	120	1/0/1	80	CH477		
		CH471	Corrosion, types of corrosion of petroleum equipment and corrosion inhibitors	6	5	150	2/0/3	105	CH476	Processing of hydrocarbon gas into fuel components and valuable chemical products	6	5	150	2/0/3	105	CH476		
CH465		Preparation and applying of reservoir and fresh water for injection into the reservoir	6	5	150	2/0/3	105	ECO003	Preparation and writing of graduation work (project)	HA	6				ECO003			
CH4610		Technology of aromatic hydrocarbons production	6	5	150	2/0/3	105	ECO003	Graduate thesis (project) defense	HA	6				ECO003			
CH460		Equipment of an oil and gas enterprise	6	5	150	2/0/3	105	CH450	Total:			25	720		7			
Total:			30	840		18												

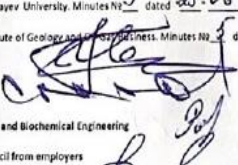
Year of study	Code	Name of discipline	Cycle	Credits	Semester
Compulsory types of training with IPPE grading					
1	AAIP101	Internship I	6	2	2
2	AAIP109	Industrial internship I	6	2	4
2-4	AAIP137	Industrial internship II	6	2	6
Additional types of training					
1	AAIP107	Sports club section	0	0	5-7
2-4	AAIPSO	Master's thesis	0	0	3-6

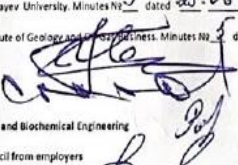
Total number of credits				
Cycle of disciplines		Credits		
		Compulsory	Elective	Total
Cycle of general disciplines (G)		51	7	58
Cycle of basic disciplines (B)		108	4	112
Cycle of special disciplines (S)		58	7	65
Total theoretical training		217	13	230
Final Attestation (FA)		12	0	12
Total		229	13	242

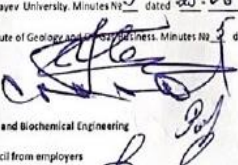
The decision of the Academic Council of the Satbayev University, Minutes No. 3 dated 25.06.2021 y.

The decision of the Academic Council of the Institute of Geology and Geochemistry, Minutes No. 5 dated 24.12.2021 y.

Vice-Rector for Academic Affairs: 

Director of IGAGB: 

Head of the Department of Chemical and Biochemical Engineering: 

Representative of the Specialty Council from employers: 

Zhuatkov B.A.

Sydykov A.H.

Rafikova Kh.S.

Selenova B.S.

## **2.4 Descriptors of the level and amount of knowledge, abilities, skills and competencies**

A - knowledge and understanding:

A1 - knowledge and understanding of the classical results of mathematics, physics, chemistry and computer science underlying the concepts, theories and principles of chemical engineering, to the extent necessary for mastering the educational program;

A2 - knowledge and understanding of basic concepts, theories and principles of chemical engineering;

A3 - knowledge and understanding of the main economic, social, environmental, ethical criteria, as well as an understanding of safety and sustainable development priorities that influence engineering decisions.

A4 - knowledge of the capabilities of computer technology in engineering and the availability of skills in using Internet communications, databases and basic software products designed to support engineering and scientific activities in the field of chemical engineering

A5 - knowledge and understanding of the theoretical foundations of industrial processes, technological schemes and the relationship of stages and features of the technological process;

A6 - knowledge and understanding of the device and principles of operation of technological equipment, devices; design features and operating modes of equipment;

A7 - knowledge and understanding of the methodology of systems analysis and design, promising directions for the development of production, industry.

B - application of knowledge and understanding

B1 - independent development and promotion of various options for solving professional problems using theoretical and practical knowledge;

B2 - the ability to apply classical scientific knowledge and traditional engineering approaches to the analysis of professional problems;

B3 - application of practical skills in laboratory and analytical work to solve professional problems of chemical engineering;

B4 - understanding the principles of operation of technological equipment and the application of methods for calculating the characteristics and dimensions of technological equipment;

B5 - the use of written and oral communication in a foreign language

B6 - solving typical professional problems in standard conditions; monitoring of technological equipment to ensure the safety of the process;

B6 - design and calculation of technological processes using modern software.

B7 - ensuring the quality conditions of technological processes for the production of basic chemicals and finished products.

C - formation of judgments

C1 - the ability to formulate the goal of the task, the choice of means and methods to achieve it,

C2 - ability to form critical judgments, demonstration of flexibility and critical thinking;

C3 - the ability to find and accept adequate solutions to the problem;

C4 - on the basic principles of construction and operation of industrial production;

C5 - on the types of professional activities in the industry;

C6 - about the tasks of professional activity in technology;

D - personality ability

D1 - the ability to work in a team based on interaction, understanding, awareness of priorities and organization of team activity;

D2 - the ability to interact and technical cooperation with specialists from related fields of engineering;

D3 - the ability to manifest interpersonal understanding, readiness for a reasonable resolution of conflicts, the desire to achieve a mutually beneficial result in negotiations;

D4 - the ability to comply with and maintain ethical norms and rules;

D5 - ability to work independently, willingness to make decisions;

D6 - the ability to persuade, show critical constructive thinking, readiness to apply new methods and approaches in difficult situations of professional activity.

## **2.5 Competencies for completion of training**

B - Basic knowledge, abilities and skills

B1 - the use of the basic laws of natural sciences and the use of methods of mathematical analysis and modeling in solving problems in the field of chemical engineering and industry, the ability to find a solution to general technical problems;

B2 - the ability to use modern information technologies, to carry out information processing using applied programs and databases for calculating technological parameters of equipment and monitoring natural environments;

B3 - have communication skills in the state, Russian and foreign languages;

B4 - knowledge of fundamental laws and methods of chemistry (biology, ecology), processes and technologies (chemical and biochemical) production;

B5 - knowledge of the main scientific and technical problems and development prospects in the field of technology for the production and processing



of oil, gas, mineral and biological raw materials, their relationship with related industries;

B5 - the ability to carry out technological calculations, determine the parameters of the technological regime and indicators, select and calculate the main technological means;

B6 - the ability to carry out a technical and economic analysis of engineering solutions;

B7 - skills in conducting a chemical experiment, methods of obtaining and researching substances and materials;

B8 - skills of working on equipment during experiments, safe handling of various chemical and biological substances.

P - Professional competencies, including according to the requirements of industry professional standards (if any)

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 - 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;

P3 - the ability to participate in the improvement of technological processes from the standpoint of energy and resource conservation, minimizing the impact on the environment.

P2 - the ability to carry out technological processes of various levels of complexity, equipment operation and ensuring their safe functioning;

P3 - the ability to apply knowledge of modern trends in the development of the industry in production and technology, design, research, and organizational and management activities.

O - Human, socio-ethical competences

O1 - striving for self-development, improving their qualifications and skills;

O2 - the ability to analyze socially significant problems and processes;

O3 - the ability to perceive the diversity of cultural traditions and customs, the ability to tolerate views

O4 - knowledge of social and ethical values based on public opinion, traditions, customs, social norms and the ability to orientate themselves on them in their professional activities;

O5 - knowledge of the tendencies of social development of society, the ability to adequately navigate in various social situations.

C - Special and managerial competencies



C1 - possession of the culture of thinking, the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it;

C2 - the ability to independently organize the work of performers, find and make managerial decisions in the field of labor organization and implementation of environmental protection measures;

C3 - the ability to analyze the technological process as a control object; C4 - the ability to organize the activities of the team, to monitor the execution of tasks.

C2 - knowledge of the basics of project management and decision-making methods used in the development, design and operation of technological processes;

C3 - knowledge of the principles of management, control and correction of activities in the context of teamwork, improving managerial and performing professionalism.

## **2.6 ECTS Diploma Supplement**

The European Diploma Supplement (hereinafter - the European Supplement), or Diploma Supplement, is, along with ECTS (European Credit Transfer System), an effective tool for ensuring academic and professional mobility in the European Higher Education Area.

The purpose of the Application is to provide comprehensive independent data in order to ensure international "transparency" and objective academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.).

Requirements:

1. The European Diploma Supplement is issued by the Kazakh National Research Technical University named after K.I.Satpayev to graduates of accredited educational programs only in strict accordance with the model developed by the Joint Working Group of representatives of the European Commission, Council of Europe and UNESCO.

2. The European Diploma Supplement does not contain any judgments of the assessment plan, comparisons with other study programs and recommendations regarding the possibility of recognition of this diploma or qualification.

3. The European Diploma Supplement consists of eight sections and must contain information on all sections. In the absence of information in any of the sections of the European Diploma Supplement, it is necessary to indicate the reasons for the refusal to provide mandatory information.

4. The European Diploma Supplement must always accompany the original document of education, as it has no legal force. The presence of the European Diploma Supplement does not guarantee the status of an educational institution, its qualifications, or the fact that it is recognized as an integral part of the national higher education system.

5. Each European Diploma Supplement must begin with a preamble:

“This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO / CEPES. The purpose of the Application is to provide comprehensive independent data in order to ensure international "transparency" and objective academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.). The application contains a description of the nature, level and status of training passed and successfully completed by the person named in the original qualification document. The Appendix does not allow judgments, statements of equivalence or proposals for recognition. Data should be reported for all eight sections. In the absence of such data, the reason must be indicated. ”

6. The European Diploma Supplement must always contain the title and the degree of qualification; the name and status of the awarding / managing institution and the classification of the qualifications. All these data must be presented in the state and English languages, since an incorrect translation misleads those who make judgments about qualifications. In cases where an alphabet other than Latin is used, transliteration is permitted. It is possible to link the titles of degrees and qualifications to the description of the higher education system in the eighth section.

7. Educational institutions should take appropriate measures to reduce to a minimum the opportunities for falsification and misrepresentation of the European Diploma Supplements issued by them.

8. Special attention should be paid to translation and terminology. To overcome the problems arising in this area, it is essential that the original language is used where indicated in the document.

9. In the European Diploma Supplement, the assessment of qualifications obtained in other countries should focus on the knowledge, skills and abilities acquired, taking into account the fact that it is not exact equivalence but “fair recognition” that should be sought.

The application consists of 8 mandatory items and is issued in English and Kazakh / Russian languages.

1. Information about the identity of the holder of the qualification
2. Qualification information
3. Information about the skill level
4. Information about the content of education and the results obtained
5. Details of qualification functions
6. Additional information
7. Testimonials of the application
8. National higher education system

## **MATHEMATICS I**

CODE - MAT101

CREDIT - 5 (1/0/2/3)

PREQUISIT - Elementary Mathematics-School Course / Diagnostic Test

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to give the future specialist a certain amount of knowledge in the sections of the course "Mathematics-I", which is necessary for the study of related engineering disciplines. Introduce students to the ideas and concepts of calculus. The main attention is paid to the formation of basic knowledge and skills with a high degree of understanding of differential and integral calculus.

Objectives of the course:

the acquisition of knowledge necessary for the effective use of rapidly developing mathematical methods; gaining the skill of building and researching mathematical models; possession of the fundamental sections of mathematics necessary for solving research and practical problems in the professional field.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Mathematics-I" provides a presentation of the sections: introduction to analysis, differential and integral calculus

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Studying this discipline will allow the student to apply the course "Mathematics-I" to solving simple practical problems, find tools sufficient for their research, and obtain numerical results in some standard situations.

## **MATHEMATICS II**

CODE - MAT102

CREDIT - 5 (1/0/2/3)

PREREQUISIT - Mathematics 1

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the course "Mathematics II" is to form in bachelors' ideas about modern mathematics as a whole as a logically harmonious system of theoretical knowledge.

The objectives of the course are to instill in students solid skills in solving mathematical problems with bringing the solution to a practically acceptable result. To develop primary skills in mathematical research of applied issues and the ability to independently understand the mathematical apparatus contained in the literature related to the student's specialty.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Mathematics-II" provides an accessible presentation of the sections: elements of linear algebra and analytical geometry, differential calculus of functions of many variables, multiple integrals. "Mathematics II" is a logical continuation of the course "Mathematics I".

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

The study of this discipline will make it possible to apply in practice the obtained theoretical knowledge and skills with a high degree of understanding in the sections of the course, to use them at the appropriate level; translate into mathematical language the simplest problems posed in terms of other subject areas; acquire new mathematical knowledge using educational and information technologies; solve applied problems in the field of professional activity

### **ENGINEERING AND COMPUTER GRAPHICS**

CODE – GEN177

CREDIT - 5 (1/1/1/3)

PREQUISIT - school drawing program

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the course is to form an understanding of modern computer graphics in general as a logically coherent system of theoretical knowledge among bachelors. Discipline is a must.

The objectives of the course are to instill in students the following skills: to depict all kinds of combinations of geometric shapes on a plane, to carry out research and their measurements, allowing the transformation of images; create technical drawings, which are the main and reliable means of information that provides communication between the designer and the designer, technologist, builder.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Engineering and Computer Graphics" provides an accessible presentation of the sections: elements of computer graphics and geometry.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Introduces students to the basics of automated preparation of the graphic part of design documents in the AutoCAD environment. Solid skills in solving math problems with bringing the solution to a practically acceptable result. To develop

primary skills in mathematical research of applied issues and the ability to independently understand the mathematical apparatus contained in the literature related to the student's specialty.

### **CULTUROLOGY**

CODE - HUM129

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT –

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to give the future specialist a certain amount of knowledge in the areas of cultural studies, which is necessary for the study of related engineering disciplines. Introduce students to the ideas and concepts of society.

#### **Objectives of the course:**

The discipline "Culturology" is designed to familiarize students with the cultural achievements of mankind, on their understanding and assimilation of the basic forms and universal laws of the formation and development of culture, on the development of their aspirations and skills for independent comprehension of the entire wealth of values of world culture for self-improvement and professional growth.

### **BRIEF DESCRIPTION OF THE COURSE**

The course of cultural studies examines the general problems of the theory of culture, leading cultural concepts, universal laws and mechanisms of the formation and development of culture, the main historical stages of the formation and development of Kazakhstani culture, its most important achievements.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

The study of this discipline will allow the student to apply the course "Culturology" to the solution of simple human relations, to find the tools sufficient to achieve them.

### **POLITICAL SCIENCE**

CODE - HUM128

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT -

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to form students' systemic knowledge about the political sphere of public life, a consistent and comprehensive study of the origins

and evolution of the political thought of the Kazakh people at a long stage of its historical development based on the materials of its richest spiritual culture, political heritage and its most prominent representatives.

Objectives of the course: to determine the place of the systematic approach in the methodology of researching politics and regime of government; reveal its specifics; analyze the main provisions of the theory of systems and the theory of the political system;

### **BRIEF DESCRIPTION OF THE COURSE**

The course on cultural studies examines common problems and factors that contribute to legitimacy, stability, adaptation of the political system; study modern models of political systems; analyze the main types of political regime, their varieties; to form the ability to analyze the peculiarities of the development of the political system and political life of peoples and states, the Republic of Kazakhstan, their transition to democracy.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

The study of this discipline will allow the student to apply the course "Political Science" to form scientific ideas about the structure, principles, functions of the political system, the mechanism of its functioning;

### **PSYCHOLOGY**

CODE - HUM122

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT -

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course The course is devoted to the study of fundamental concepts in the field of general psychology. The general idea of psychology as a science, methodology and methods of psychology are considered.

**Course objectives:** The discipline contributes to the formation of a holistic view of the personality traits of a person as a factor in the successful mastery and implementation of educational and professional activities, the ability to make decisions more effectively based on knowledge of the psychological nature of a person and society.

### **BRIEF DESCRIPTION OF THE COURSE**

The possibility of using the studied methods in the future professional activity of students is considered. The object of the discipline is mental processes,



properties and states of a person in various areas of human activity, interpersonal and social interactions, methods and forms of their organization and changes when influenced from the outside.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the standpoint of psychological aspects.

### **FUNDAMENTALS OF ENTREPRENEURSHIP, LEADERSHIP AND ANTI-CORRUPTION CULTURE**

CODE - MNG487

CREDIT - 3 (1/0/1/2)

PRE-REQUISIT -

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course The goal of the discipline is to acquire practical skills in entrepreneurial activity, familiarization with theories and types of leadership, and an understanding of the foundations of anti-corruption culture.

**Objectives of the course:** Students will study the theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures. They will develop their leadership and teamwork skills. They will also study the causes of corruption and methods to combat it.

### **BRIEF DESCRIPTION OF THE COURSE**

The possibility of using the studied methods in the future professional activity of students is considered. The object of the discipline is the processes, properties and states of a person in various fields of human activity.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the position of studying the causes of corruption and methods to combat it.

### **LIVING SAFETY**

CODE - CHE451

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT –

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course "Life Safety" is to form students' ability to recognize and evaluate negative factors of the human environment, to determine the consequences of harmful and damaging factors for a person, to implement reliable methods of protection against them, to choose the optimal solution and correct behavior, safety and preservation of life when emergency situations of natural, man-made and social nature.

**Course Objectives:** Students will study the theory and practice of safe human life. They will develop their leadership and teamwork skills. They will also explore the causes of work injury and how to deal with it.

### **BRIEF DESCRIPTION OF THE COURSE**

The possibility of using the studied methods in the future professional activity of students is considered. The object of the discipline is the processes, properties and states of a person in various fields of human activity.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the position of studying the causes of negative factors of the human environment.

### **SOCIOLOGY**

CODE - HUM127

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT -

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main objective of the course The course is devoted to the study of fundamental concepts in the field of sociology. The general idea of sociology as a science, methodology and methods of sociology are considered.

**Course objectives:** The main goal of the course "Sociology" is to form students' understanding of sociology as an academic and applied discipline -

mastering the system of basic sociological concepts, mastering the basic methods of empirical sociology, familiarizing with the application of sociological approaches to the study of social phenomena and processes.

### **BRIEF DESCRIPTION OF THE COURSE**

Studying the foundations of sociology plays a crucial role in terms of personal development and socialization, helps students to scientifically comprehend complex phenomena and processes of social life, their essence, content, dynamics of development, as well as to understand existing sociological theories that explain these social phenomena and processes and reveal mechanisms their research.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the position of sociological aspects.

### **ECOLOGY AND SUSTAINABLE DEVELOPMENT**

CODE - CHE452

CREDIT - 2 (1/0/0/1)

PRE-REQUISIT –

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is the formation of environmental knowledge and consciousness, gaining in-depth knowledge about general ecology, the foundations of sustainable development of nature and society, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection, as well as to have an idea of the goals and indicators of sustainable development.

- to acquaint students with the environmental problems of our time;
- to study the basic laws of living nature, various ecological systems, the biosphere as a whole and its stability;

Objectives of the course: - to form knowledge about the environmental consequences of human economic activity in the context of the intensity of nature management; - to form a complex form and creative thinking in the analysis of complex and acute problems of ecology, environmental protection and sustainable development.

### **BRIEF DESCRIPTION OF THE COURSE**

Ecology: subject of study, tasks and methods. Short story. Sections of ecology. The field of ecology. Ecology of individuals - Autecology. Habitat.

Environmental factors and their classification. Adaptation. The main patterns of action of environmental factors. Population ecology - Demecology. The concept of the population. Population static indicators. Dynamic indicators of the population. Environmental strategy for survival. Community ecology - Synecology. Species, spatial and ecological structures of the biocenosis. Types of connections and relationships between organisms in an ecosystem. Successions. Classification of natural ecosystems. Ecological systems. Food chains and networks. Ecological pyramid and its types. The circulation of substances and the flow of energy. The doctrine of the biosphere. The structure and properties of the biosphere. The biosphere and its stability. The biosphere as a global ecosystem. Pedosphere as part of the biosphere. Basic properties of the biosphere. Biodiversity. The circulation of substances and anthropogenic circulation. Evolution of the biosphere. Noosphere as a stage in the evolution of the biosphere. Anthroposphere. Global ecological problems of our time. Sustainable development: concept, principles. The history of the emergence of the concept of "sustainable development". Sustainable Development Indicators. Sustainable Development Goals. Significance of green technologies and efficient use of renewable resources for sustainable development. Nature protection and sustainable development. Problems of nature protection. Specially protected areas. Species specially protected and listed in the Red Book of Kazakhstan. Actual ecological problems of the Republic of Kazakhstan.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

In the course of studying the course, students acquire theoretical knowledge, practical skills and abilities, forming their professional orientation from the position of studying the causes of complex and acute problems of ecology, environmental protection and sustainable development.

### **PHYSICS I, II**

CODE - PHYS111-112

CREDIT - 5 (1/1/1/3)

PREQUISIT - diagnostic test / PHYS110-111

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

the main purpose of teaching the course Physics I and Physics II is to form ideas about the modern physical picture of the world and scientific outlook.

### **BRIEF DESCRIPTION OF THE COURSE**

Disciplines Physics I and Physics II are the basis of theoretical training for engineering and technical activities of graduates of a higher technical school and represent the core of physical knowledge necessary for an engineer operating in the world of physical laws. The course "Physics 1" includes sections: physical foundations of mechanics, structure of matter and thermodynamics, electrostatics

and electrodynamics. The discipline "Physics II" is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of general physics as one of the basic components of the general theoretical training of bachelors of engineering and technical profile. The discipline "Physics II" includes sections: magnetism, optics, nanostructures, fundamentals of quantum physics, atomic and nuclear physics.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

- the ability to use knowledge of fundamental laws, theories of classical and modern physics, as well as the use of physical research methods as the basis of a system of professional activity.

### **MODERN HISTORY OF KAZAKHSTAN**

CODE - HUM100

CREDIT - 5 (1/0/2/3)

PRE-REQUISIT – no

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is to familiarize students of technical specialties with the main theoretical and practical achievements of domestic historical science on the problems of the history of modern Kazakhstan, an integrated and systematic study of the main stages of the formation and development of Kazakhstani society.

- to analyze the peculiarities and contradictions of the history of Kazakhstan in the Soviet period;

- to reveal the historical content of the foundations of the laws of political, socio-economic, cultural processes at the stages of the formation of an independent state;

- to contribute to the formation of students' civic position;

- to educate students in the spirit of patriotism and tolerance, belonging to their people, Fatherland;

### **BRIEF DESCRIPTION OF THE COURSE**

The course Modern history of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. The modern history of Kazakhstan studies the national liberation movement of the Kazakh intelligentsia at the beginning of the 20th century, the period of the creation of the Kazakh ASSR, as well as the process of the formation of a multinational society. KNOWLEDGE, SKILLS,

### **COURSE COMPLETION SKILLS**

- knowledge of events, facts and phenomena of the modern history of Kazakhstan;
- knowledge of the history of ethnic groups inhabiting Kazakhstan;
- knowledge of the main stages of the formation of Kazakh statehood;
- the ability to analyze complex historical events and predict their further development;
- the ability to work with all types of historical sources;
- the ability to write essays and scientific articles on the history of the Fatherland;
- the ability to operate with historical concepts;
- the ability to conduct a discussion; - skills of independent analysis of historical facts, events and phenomena; - public speaking skills.

### **KAZAKH / RUSSIAN LANGUAGE**

CODE - LNG104

CREDIT - 5 (0/0/3)

PREQUISIT - diagnostic test

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

- to teach students to listen to statements on well-known topics related to home, study, free time;
- understand texts on personal and professional topics containing the most common words and expressions;
- be able to conduct a conversation on everyday topics; describe your experiences; tell your opinion; retell and evaluate the content of the book read, the film seen;
- be able to create simple texts on well-known topics, including those related to professional activities.

### **BRIEF DESCRIPTION OF THE COURSE**

The language material of the course is selected in such a way that the student, assimilating the lexical and grammatical minimum, has the opportunity to get acquainted with typical communicative situations and he himself finds himself in such situations, knows how to correctly evaluate them and choose the appropriate model (strategy) of speech behavior.

At the same time, the main emphasis of teaching is shifted from the process of transferring knowledge to teaching the ability to use the language being studied in the implementation of various types of speech activities, which are reading (subject to reading comprehension), listening (under the same condition) and production of texts of a certain complexity with a certain degree of grammatical and lexical correctness.



The material for classes is selected so that students, while studying the Kazakh / Russian language, acquire the skills of reading, writing and understanding sounding speech based on the simultaneous mastering of the basics of grammar (phonetics, morphology and syntax) and word usage in the course of constant repeated repetition with a gradual complication of tasks.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

A student, subject to active organization of work in the classroom and conscientious completion of homework, by the end of the first semester, acquires skills and abilities corresponding to the all-European level A2 (Threshold according to ALTE classification), that is, is on the threshold of the level of independent language proficiency.

**ENGLISH**

CODE – LNG108

CREDIT – 5 (0/0/3)

PREQUISIT – diagnostic test/LNG1051-1056

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**LNG1051**

**PURPOSE AND OBJECTIVES OF THE COURSE**

The “Beginner English” discipline is designed primarily for learning from scratch. This course is also suitable for those who have only general elementary knowledge of the language. After passing this level, the student will be able to confidently communicate on basic topics in English, learn the basics of grammar and lay a certain foundation that will improve their skills at the next stage of learning English.

Course post-requisites: Elementary English.

**LNG1052**

**PURPOSE AND OBJECTIVES OF THE COURSE**

The discipline "Elementary English" is the foundation of learning English, which is aimed at developing students' receptive skills (reading and listening) and productive skills (writing and speaking), analyzing basic knowledge, using and memorizing the main grammatical rules and mastering the features of pronunciation and elementary vocabulary, and encouraging self-study and critical thinking.

Course prerequisites: Beginner.

Course post-requisites: General 1.

**LNG1053**

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the General English1 course is to provide students with the opportunity to acquire sufficient knowledge to become more free in their everyday social and academic settings. Students work to improve pronunciation, vocabulary and grammar. At this level, the main task will be to consolidate the skills acquired earlier, to learn how to compose and correctly apply complex syntactic constructions in English, as well as to achieve really good pronunciation.

Course prerequisites: Elementary English.

Course post-requisites: General 2.

**LNG1054**

**PURPOSE AND OBJECTIVES OF THE COURSE**

The GeneralEnglish 2 course is intended for students who continue to study GeneralEnglish 1. The course is focused on the ability to actively use in practice

most aspects of the tenses of the English language, conditional sentences, passive phrases, etc. At this stage, the student will be able to maintain a conversation with several interlocutors or express their point of view. The student significantly expands his vocabulary, which will allow him to freely express his thoughts in any environment. At the same time, speech will be replenished with various synonyms and antonyms of already familiar words, phrasal verbs and stable expressions.

Course prerequisites: General 1.

Course post-requisites: AcademicEnglish.

### **LNG1055**

#### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the "Academic English" course is to develop academic language skills. The discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, presentation, etc.) This course is designed to help students become more successful and effective in their learning, developing critical thinking skills and independent learning.

Course prerequisites: General 2.

Course post-requisites: Professional English.

### **LNG1056**

#### **PURPOSE AND OBJECTIVES OF THE COURSE**

“BusinessEnglish” is the English language for business communication, business and career. Knowledge of business English is useful for negotiating and business correspondence, preparing presentations and informal communication with business partners.

The peculiarities of training are that it is necessary not only to master the vocabulary, but also to master new skills: presentation, communication, language, professional.

Prerequisites of the course: IELTS score 5.0 and / or Academic English

Post-requisites of the course: Professional English, IELTSscore 5.5-6.0

### **LNG1057**

#### **PURPOSE AND OBJECTIVES OF THE COURSE**

The “Professional English” course is designed for B2 + level students, the aim of which is to improve the language competence of students in their respective professional fields. The main goal of the course is to teach students to work with texts, both audio and written, in their specialty. The curriculum is built on the necessary vocabulary (words and terms), often used in English for specific purposes. Students will acquire professional English language skills through integrated content and language-based learning, master vocabulary in order to read

and understand original sources with a great degree of independence, and practice different communication models and vocabulary in specific professional situations.

Course prerequisites: Business English.

Course post-requisites: any elective course.

### **PHYSICAL EDUCATION**

CODE – KFK-101-102-103-104

CREDIT - 2 (0/0/2/2)

PREQUISIT -

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

**The main purpose of the course** - The purpose of physical education of Satbayev University students is to form a personality and the ability to use a variety of means of physical culture and sports to preserve and strengthen health, psychophysical training and self-preparation for future professional activity.

Course objectives: in

order to achieve this goal, it is planned to solve the following educational, educational, developmental and health-improving tasks:

Understanding the social role of physical culture in personal development and preparation for future professional activity;

Knowledge of the scientific, biological and practical foundations of physical culture, and a healthy lifestyle;

Formation of a motivational and value attitude to physical culture, attitudes towards a healthy lifestyle, physical self-improvement and self-education, the need for regular physical exercises and sports;

Mastering a system of practical skills and abilities that ensure the preservation and strengthening of health, mental well-being, development and improvement of psychophysical abilities, qualities and properties of personality, self-determination in physical culture;

Provision of general and professionally applied physical fitness, which determines the psychophysical readiness of a student for a future profession;

Gaining experience in the creative use of physical culture and sports activities to achieve life and professional goals.

Familiarization with the rules of judging by sports.

### **BRIEF DESCRIPTION OF THE COURSE**

The course is intended for 1st year students of all specialties

As part of the course, the student will master the practical use of the skills of performing the basic elements of athletics techniques, sports games, gymnastics and a set of standards for general physical training, including professionally applied physical training or one of the sports, methods of conducting independent physical exercises.

Basic knowledge and skills in the field of physical culture and sports will be presented, as well as methods of building and rationing the load during independent classes; methods of compiling complexes of hygienic gymnastics and general developmental exercises;

The final stage of the course is a multivariate test and/ or the fulfillment of the established standards for general physical, sports and professional applied training.

After completing the course, the student must understand the role of physical culture and a healthy lifestyle; know the basics of physical culture and a healthy lifestyle; possess a system of practical skills and abilities that ensure the preservation and strengthening of health, development and improvement of psychomotor abilities and qualities.

The student must be able to:

- to dose the load during wellness and independent physical exercises;
- evaluate the volume and intensity of physical activity, taking into account age and health status;
- use the methods and means of PFP;
- to use a set of exercises on OFP, SFP and include sports and outdoor games, national games.

At the end of the course, the student should know:

- the purpose and objectives of physical training;
- content of training sessions;
- rules for building and rationing the load during independent studies; - rules and methodology for composing complexes of hygienic gymnastics and general developmental exercises;
- orientation of professional and applied physical training;
- sets of exercises on OFP, SFP and the content of games used in practical classes.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The student must be able to:

- to dose the load during wellness and independent physical exercises;
- evaluate the volume and intensity of physical activity, taking into account age and health status;
- use the methods and means of PFP;
- to use a set of exercises on OFP, SFP and include sports and outdoor games, national games.

At the end of the course, the student should know:

- the purpose and objectives of physical training;
- content of training sessions;

- rules for building and rationing the load during independent studies; - rules and methodology for composing complexes of hygienic gymnastics and general developmental exercises;
- orientation of professional and applied physical training;
- sets of exercises on OFP, SFP and the content of games used in practical classes.

## **INTRODUCTION TO SPECIALTY**

CODE - CHE646

CREDIT - 4 (1/0/1/2)

PREQUISIT - SCHOOL CHEMISTRY COURSE

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## **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to acquaint students who have started their studies at the university with the basic and basic provisions of the specialty and training program. The main attention is paid to the formation of basic knowledge and skills necessary for the study of engineering disciplines.

### **Objectives of the course:**

acquisition of knowledge necessary for the effective mastering of disciplines of a specialized nature; obtaining skills in describing and designing the main types of chemical and biochemical reactors; possession of fundamental knowledge of natural sciences for solving research and practical problems in the professional field.

## **BRIEF DESCRIPTION OF THE COURSE**

The course "Introduction to the specialty" describes the basic sequence of fields of science - chemistry by engineering, substantiates their interrelationships and differences, teaches to understand and read flow and non-flow forms of production processes, schemes of petrochemical transformations as the basic alphabet of chemical and biochemical engineering.

## **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Student

must know:

- basic concepts of petrochemicals;
- basic laws of petrochemicals;
- the role and importance of the professional activity of a process engineer.

should be able to:

- to describe mathematically the main types of petrochemical reactors;



- read simple flow and non-flow forms of production processes of chemical industries;
- to design a simple type of reactor and a simple type of process according to the given conditions.

## **INFORMATION AND COMMUNICATION TECHNOLOGIES (IN ENGLISH)**

CODE – CSE677

CREDIT - 5 (2/1/0)

PRE-REQUISIT - no

### **PURPOSE AND OBJECTIVES OF THE COURSE**

- o Training in the skills of applying modern information technologies in the field of professional activities. The objectives of the course include:
  - o Reveal the basic concepts of the architecture of computer systems;
  - o To reveal the basic concepts of information and communication technologies and subject terminology;
  - o To teach to work with software interfaces of operating systems;
  - o To teach how to work with data in various representations, both tabular structured and unstructured form;
  - o Teach to apply the basic principles of information security;
  - o Expand the concepts of data formats and multimedia content. To teach how to work with typical applications for processing multimedia data. Use modern approaches to the presentation of the material;
  - o Explain the concepts of modern social, cloud and email platforms and how to work with them;
  - o To teach how to use algorithms and programming methods to solve problems of automating business processes

### **BRIEF DESCRIPTION OF THE COURSE**

The course contains a training program aimed at leveling the basic knowledge of students in the field of information and communication technologies. Contains a full range of topics, according to the Standard Curriculum of the State Educational Standard of Education, with a predominance of training practical skills in working with data, algorithmization and programming. The course is structured in such a way as to teach students not only the basic concepts of architecture and modern infrastructure of information and communication technologies, but also to teach how to use these tools to solve problems of an applied nature. To teach how to optimize processes, apply adequate models and methods for solving practical



problems using modern methods and tools of information technology, automate routine processes, be productive and efficient.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Students will know:

- Computer device;
- Architecture of computing systems;
- Infrastructure of information and communication technologies;
- Interfaces of modern operating systems;
- Modern tools for working with data of various nature and purpose;
- Types of information security threats, principles, tools and methods of data protection;
- Python programming language.

Students will be able to:

- Work with interfaces of modern operating systems;
- Work with modern application software for working with data of various nature and purpose;
- Apply modern social, cloud, email platforms for organizing business processes;
- Program in an algorithmic programming language;
- Analyze, simulate, проектировать, внедрять, тестировать и оценивать системы информационно-коммуникационных технологий

### **PHILOSOPHY**

CODE - HUM132

CREDIT - 5 (1/0/2/3)

PREREQUISIT - Modern history of Kazakhstan

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is the formation of cognitive, operational, communicative, self-educational competencies

to solve problems:

- contribute to the development of adequate world outlook guidelines in the modern world;
- to form creative and critical thinking in students;
- to distinguish between the ratio of spiritual and material values, their role in the life of a person, society and civilization;
- contribute to the definition of their attitude to life and the search for harmony with the surrounding world.

### **BRIEF DESCRIPTION OF THE COURSE**

"Philosophy" is the formation of a holistic worldview that has developed in the context of the socio-historical and cultural development of mankind. Acquaintance with the main paradigms of the methodology of teaching philosophy and education in the classical and post-classical traditions of philosophy. Philosophy is called upon to develop stable life guidelines, the acquisition of the meaning of one's being as a special form of spiritual production. Contributes to the formation of a moral character of a person with the ability to critical and creative thinking. The theoretical sources of this course are the concepts of Western, Russian, Kazakh scientists on the history and theory of philosophy.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

- knowledge of basic terms, main concepts and problems of philosophy;
- knowledge of the main philosophical ways of solving worldview issues in the context of culture;
- the ability to analyze the history of the development of philosophical thought;
- the ability to identify alternative ways of posing and solving worldview issues in the history of human development;
- the ability to identify the main theoretical approaches in the relationship between a person and society;
- the ability to master the methodology of performing independent work;
- skills of searching for systematization of the material;
- skills to freely discuss and make rational decisions;
- skills of ethical principles in professional activity.

### **GENERAL CHEMISTRY**

CODE – CHE494

CREDIT - 5 (1/1/1/3)

PREQUISIT - diagnostic test

### **PURPOSE AND OBJECTIVES OF THE COURSE**

Purpose of the course: Formation of knowledge on fundamental issues of general chemistry and the skills of their application in professional activities.

Objective of the course:

- formation of knowledge of the basic laws of chemistry and chemical properties of elements and their compounds, understanding and application of which will allow both to improve existing and create new technological processes
- transfer basic theoretical knowledge of the chemistry course;
- acquisition of skills to use the laws of chemistry when describing and comparing specific professional tasks;
- help students gain skills in performing laboratory work;

- acquisition of skills for solving typical problems and drawing up reaction equations;
- what contributes to the informal assimilation of theoretical material;
- formation of students' skills in chemical thinking.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "General Chemistry" examines the laws, theoretical provisions and conclusions that underlie all chemical disciplines, studies the properties and relationships of chemical elements based on the periodic law of D. I. Mendeleev and on modern ideas about the structure of matter, the foundations of chemical thermodynamics and kinetics, processes in solutions, the structure of complex compounds.

Study of the Periodic Table and the structure of the atoms of the elements; chemical bond (covalent bond, valence bond method, hybridization, molecular orbital method, ionic bond, chemical bond in complex compounds); atomic and molecular structures; properties and physical states of matter; the main classes of inorganic compounds; solutions (ways of expressing concentrations, ideal and non-ideal solutions, activity, electrolyte solutions, electrolytic dissociation, salt hydrolysis); foundations of chemical thermodynamics and kinetics.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

As a result of mastering the discipline, students should

1) know:

- basic chemical laws and concepts,
- the structure of the Periodic Table of the Elements of DI Mendeleev and the main characteristics of the elements and their compounds resulting from it;
- basic laws of chemical reactions,
- nomenclature of chemical compounds;
- ways of expressing the concentration of substances in solutions;
- rules for safe work in a chemical laboratory.

2) be able to:

- to determine the chemical properties of elements and their compounds by their position in the Periodic Table of the elements of DI Mendeleev;
- apply the basic laws of chemistry in solving their professional problems;
- paint the reaction equations,
- to calculate the concentration of solutions and prepare solutions of a given concentration.

3.to have skills:

- the use of chemical laws to solve specific professional problems with quantitative calculations and the use of educational, reference and special literature;

- drawing up chemical equations, explaining the properties of elements and their compounds by position in the Periodic Table of the elements of D.I. Mendeleev, conducting chemical experiments and explaining the phenomena occurring.

## **ORGANIC CHEMISTRY I (CHEMISTRY OF ALIPHATIC COMPOUNDS)**

CODE – CHE635

CREDIT - 5 (1/1/1/3)

PREREQUISIT - SCHOOL CHEMISTRY

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to give the fundamental foundations of organic chemistry of aliphatic compounds, to show its significance and role as a theoretical basis for the most important branches of the chemical industry, as well as to consider the issues of synthesis, analysis and optimization of organic synthesis processes.

Objectives of the course:

Objectives of the discipline: creating the foundations of students' theoretical training for solving practical problems; the formation of students' scientific thinking, in particular, understanding of the logical connection between the structure and reactivity of organic compounds, about the compounds themselves and the methods of their preparation;

### **BRIEF DESCRIPTION OF THE COURSE**

Organic chemistry I is the chemistry of linear hydrocarbons and their oxygen- and nitrogen-containing derivatives. She studies the physical and chemical properties of these compounds, methods of production in the laboratory and industry, as well as their use in various sectors of the national economy. The purpose of the course is to give the fundamental foundations of organic chemistry of alicyclic compounds, to show its significance and role as a theoretical basis for the most important branches of the chemical industry.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

After mastering the program of this discipline, the student must

Know the features of organic compounds, the basis of the theory of the structure of organic substances, the main classes of organic compounds, methods of their preparation;

Be able to classify organic compounds; to compose the names of organic compounds and structural formulas of organic compounds by their names;

Have skills in drawing up names and structural formulas, schemes and mechanisms of organic reactions; predicting the physical and chemical properties of organic compounds;

## **ORGANIC CHEMISTRY II (CHEMISTRY OF CYCLIC COMPOUNDS)**

CODE – CHE639

CREDIT - 5 (1/1/1/3)

PREQUISIT - CHE 153 ORGANIC CHEMISTRY 1

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to master the complex of knowledge and scientific ideas about the fundamental theoretical and experimental foundations of organic chemistry of cyclic compounds; mastering the skills to characterize the structure, physical and chemical properties of cyclic organic substances; mastering experimental teachings and skills.

#### **Course objectives**

Studying the discipline "Organic Chemistry II" contributes to the formation of key competencies that ensure the successful mastering of the theoretical base of fundamental knowledge in organic chemistry for the most important branches of the chemical and biochemical industry, its relationship with agriculture and medicine, the acquisition of skills in a chemical experiment, general methods of work in laboratories, as well as carry out basic chemical reactions and methods for the synthesis of organic compounds. Successful mastering by students of the program of the course "Organic Chemistry II" will contribute to the training of specialists for objects of industrial, scientific, technical and educational activities.

### **BRIEF DESCRIPTION OF THE COURSE**

To acquaint students with cyclic compounds, with the classification - carbocyclic, heterocyclic. Cycloparaffins, their nomenclature and isomers, describe the physical and chemical properties, methods of production. Especially for mononuclear arenes and their functional derivatives - phenols and aromatic alcohols, nitro compounds and amines. Aromatic heterocyclic compounds and their relationship are described separately.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

Know the general laws connecting the structure and properties of cyclic organic compounds;

- methods of obtaining the main classes of cyclic compounds, mechanisms of the main types of reactions;
- the basics of drawing up installations for organic synthesis and purification of organic compounds, safety rules when working with organic substances.

To be able to solve problems related to the technology of organic substances, to synthesize and identify cyclic compounds.

- types of organic reactions and mechanisms of their course, factors influencing the reaction;
- write the necessary elements of a given chain of transformations of organic cyclic compounds;
- to carry out a simple synthesis of cyclic compounds.

Possess the skills of working with various organic (liquid, solid, flammable, volatile, toxic) substances, with instruments, laboratory glassware and equipment of the organic synthesis laboratory;

- methods of separation, isolation, purification, identification and synthesis of organic cyclic compounds.

### **GENERAL CHEMICAL TECHNOLOGY**

CODE – CHE570

CREDIT - 5 (2/1/0/3)

PREREQUISIT - CHE192 "GENERAL CHEMISTRY"

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to give the fundamental foundations of general chemical technology, to show its significance and role as a theoretical basis for the most important branches of the chemical industry, as well as to consider the optimization of processes.

**Objectives of the discipline:** creating the foundations of students' theoretical training for solving practical problems; the formation of students' scientific thinking, in particular, understanding of the logical connection between processes, about the processes themselves;

### **BRIEF DESCRIPTION OF THE COURSE**

Chemical production. Hierarchical organization of processes in chemical production, criteria for evaluating production efficiency. General laws of chemical processes, industrial catalysis, chemical reactors. Basic mathematical models of processes in chemical reactors, isothermal and non-isothermal processes in



chemical reactors, industrial chemical reactors. Chemical-technological systems (CHS): structure and description of CHS, synthesis and analysis of CHS, raw material and energy subsystems of CHS.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

After mastering the program of this discipline, the student must

Know the features of chemical technological processes, the basis of the theory of the structure of chemical technological processes, individual representatives and ways of their practical application;

Be able to classify chemical engineering processes; predict chemical-technological processes, describe the mechanisms of the main types of chemical transformations with their participation, plan the conduct of chemical-technological processes.

Have skills in drawing up basic mathematical models of processes in chemical reactors, isothermal and non-isothermal processes in chemical reactors, industrial chemical reactors, information processing, have skills in working with a computer as a means of information management;

### **PHYSICAL CHEMISTRY**

CODE - CHE127

CREDIT - 5 (1/1/1/3)

PRE-REQUISIT - CHE 192 "General chemistry"

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course

- Form students:

- the ability to understand the physicochemical essence of processes and use the basic laws of physical chemistry in complex industrial and technological activities;

- the ability to perform calculations of physical and chemical parameters of chemical processes based on the methods of physical chemistry;

- the ability to understand the physicochemical essence of electrochemical processes and the theory of electrolytes, to use the basic laws of electrochemistry in complex industrial and technological activities;

- the ability to understand the essence of the chemical kinetics of processes and use the basic laws of chemical kinetics in complex production and technological activities;

- the ability to understand and describe the patterns of complex reactions and propose mechanisms for complex reactions based on kinetic patterns;

- the basics of understanding the kinetics of catalytic processes and their applications in industrial practice.

### **Objectives of the course:**

The main tasks of studying the discipline include:

- study of the main sections of physical chemistry - chemical thermodynamics, chemical kinetics, electrochemistry, photochemistry, the study of gases, solutions, chemical and phase equilibria, catalysis;
- providing students with creative thinking, combining fundamental knowledge of the basic laws and methods of conducting physical and chemical research with subsequent processing and analysis of the results.
- finding the relationship between chemical and physical processes.

### **BRIEF DESCRIPTION OF THE COURSE**

The course of the discipline will consider the laws of thermodynamics and thermodynamic potentials, chemical and phase equilibrium in one-component and two-component systems, state diagrams of one-component and two-component systems, thermal analysis, solid solutions, properties and thermodynamics of solutions, electrolytes, electrical conductivity and electrochemical potentials, thermodynamic description of processes and equilibrium in electrochemical systems, peculiarities of electrochemical systems, galvanic cells, electrolysis and its application, corrosion and protection of metals. Formal kinetics: reaction rate, reaction rate constant, half-life, reaction order, influence of temperature on the reaction rate. The theory of active collisions. Transient State Theory. Kinetics of complex reactions: reversible, parallel and sequential reactions. Stationary concentration method. Fundamentals of the kinetics of catalytic processes. Photochemical reactions.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

After mastering this discipline, the student must know: the laws of thermodynamics; basic equations of chemical thermodynamics; methods of thermodynamic description of chemical and phase equilibria in multicomponent systems; properties of solutions; fundamentals of electrochemistry; basic concepts, theories and laws of chemical kinetics and catalysis.

The student must be able to: calculate the thermodynamic parameters of systems; determine the thermodynamic characteristics of chemical reactions and equilibrium concentrations of substances; determine the direction of the process in the given initial conditions; predict the influence of various factors on the equilibrium in chemical reactions; to establish the boundaries of the phase regions in one-component and binary systems; calculate heat effects and equilibrium constants of chemical reactions; carry out the necessary physical and chemical calculations; calculate the rate and rate constant of chemical reactions, half-transformation time, determine the order of the reaction, be able to describe the

kinetics of simple and complex reactions, determine the degree of conversion, make an assumption about the reaction mechanism based on kinetic data.

### **CAD CHEMICAL AND BIOLOGICAL ENGINEERING I**

CODE – CHE588

CREDIT - 5 (0/1/2/3)

PREREQUISITES - CHE199 "PHYSICAL CHEMISTRY"

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to acquaint students with the basics of computer modeling of chemical-technological processes using the ChemCad simulation software package. ChemCad software allows you to create, analyze and optimize various options for technological design of production processes, evaluate their efficiency and choose the best one.

#### **Objectives of the course:**

To provide students with the theoretical knowledge and practical skills necessary to create and optimize, using the ChemCad simulation software package, complex technological schemes of various processes involving organic and inorganic substances, including recycle flow and for performing complex technological calculations.

### **BRIEF DESCRIPTION OF THE COURSE**

The course of the discipline will consider the basics of computer modeling of chemical technological processes using the ChemCad simulation software package, modeling equilibrium (stationary) chemical technological processes, methods for constructing a technological scheme, the choice of thermodynamic parameters and a method for determining the K-constant, characteristics of the technological scheme and flows.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

The study of this discipline will allow the student to correctly apply computer modeling methods to describe the laws of technological processes; build chemical-technological schemes using the ChemCad Simulation Software Package.

### **CAD CHEMICAL AND BIOLOGICAL ENGINEERING II**

CODE – CHE589

CREDIT - 5 (0/1/2/3)

PREREQUISITES - CAD CHEMICAL AND BIOLOGICAL  
ENGINEERING I

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course - ChemCad program allows you to create, analyze and optimize various options for technological design of production processes, evaluate their efficiency and choose the best one.

#### **Objectives of the course:**

To provide students with the theoretical knowledge and practical skills necessary to create and optimize, using the ChemCad simulation software package, complex technological schemes of various processes involving organic and inorganic substances, including recycle flow and for performing complex technological calculations.

### **BRIEF DESCRIPTION OF THE COURSE**

The course of the discipline will consider modeling chemical technological processes using a periodic distillation column, calculating a simple technological scheme with a recycle, assessing the possibility of a pinch effect, calculating material and heat balances in the development of technology and designing production, analyzing parametric sensitivity, total mass and heat balance, process optimization.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

The study of this discipline will allow the student to correctly apply computer modeling methods to describe the laws of technological processes; find the optimal conditions for the implementation of chemical and technological processes; calculate and analyze the processes of heat and mass transfer.

### **HARDWARE DESIGN OF OIL AND GAS REFINING PROCESSES I**

CODE - CHE467

CREDIT - 5 (2/0/1/3)

PREREQUISITES - INTRODUCTION TO THE SPECIALTY, PHYSICS II.

**The purpose of the discipline:** is to study the patterns and mathematical description of hydromechanical and heat exchange processes occurring in systems with several phases and several components and the development of methods for calculating equipment, choosing a rational design and determining the size of devices.

**Abstract:** Classification of the main processes and devices of chemical technology. Methodology for calculating devices. Equilibrium equations for an ideal fluid. Equations of motion for ideal fluids. Separation of heterogeneous

systems. Mixing. Mixing types. Heat transfer processes. Thermal conductivity. Heating, cooling and condensation processes. Evaporation.

**Expected Results:** The course "Hardware design of oil and gas processing processes I" is an important engineering special discipline, which is an important section of the theoretical foundations of chemical technology. Laboratory and independent studies allow you to consolidate the lecture material, develop a research approach to the study of the subject in students. Homework in the form of problem solving allows students to develop independence and study the subject more deeply. The program is designed in such a way as to contribute to the maximum extent to the formation of specialists of a wide profile who are able to quickly solve complex practical problems of modern production.

The student should know: the basic laws of the flow of hydromechanical and heat exchange processes, the design and principles of the apparatus used in these processes.

The student should be able to: make calculations of the processes and devices of hydromechanical and heat exchange processes, perform constructive calculations of devices, use programs for calculating on a computer and reference literature for a reasonable choice of equipment.

## **HARDWARE DESIGN OF OIL AND GAS REFINING PROCESS II**

CODE - CHE468

CREDIT - 5 (2/0/1/3)

PREREQUISITES - HARDWARE DESIGN OF OIL AND GAS PROCESSING PROCESSES I.

POST-REQUISITES - ORGANIC AND PETROCHEMICAL PRODUCTION TECHNOLOGIES

**The purpose of the discipline:** is to study the patterns and mathematical description of mass transfer processes occurring in systems with several phases and several components and the formation of knowledge and skills in the field of processes and devices of chemical technology and practical calculations of processes and devices.

**Abstract:** mass transfer processes, calculation and selection of apparatuses and structures; comparative analysis of the operation of devices, finding the optimal conditions for carrying out technological processes. As a result of studying the proposed discipline, a certified specialist must know and understand: the physical essence and theoretical foundations of the basic processes of chemical

technology; hardware and technological design of the main processes, the principle of operation of devices; methods for calculating the main processes and devices.

The course project is the final stage in the study of the discipline. During the period of work on the course project, students will be able to apply the acquired theoretical and practical skills, for independent work on performing calculations of chemical equipment and graphic design of design objects, get acquainted with the current regulatory and technological documentation, reference literature, acquire skills in choosing equipment and feasibility studies.

**Expected results:** As a result of studying the proposed discipline, a future graduate should be able to make a material and energy calculation of the process and determine the optimal parameters for its conduct; to carry out design and engineering calculations of the main devices providing this process.

The student should know: the basic laws of the course of mass transfer processes associated with the transfer of matter from one phase to another, about the designs and principles of operation of the apparatus used in these processes.

The student must be able to: make calculations of devices, use programs for calculating on a computer and reference literature for a reasonable choice of equipment.

## **FIELD PREPARATION OF OIL AND GAS**

CODE - CHE456

CREDIT - 5 (2/0/1/3)

## **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline is the acquisition by students of basic knowledge related to oil and gas production, their processing, pipeline transportation of oil and gas, storage and distribution of oil, petroleum products and gas, construction and operation of pumping and compressor stations, pipelines and storage facilities.

## **BRIEF DESCRIPTION OF THE COURSE**

Field oil preparation includes the following stages: Degassing - carried out in separators to separate gas from oil. The volume of extraction of the degassed product from the same amount of reservoir emulsion depends on the number of separation steps.

## **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

A graduate who has mastered the discipline:



Must know:

basic concepts, definitions and professional terminology;  
methods of calculation of the main technical devices and installations;  
methods and methods of oil and gas preparation;  
organization of scientific research in Russia;

methodology of conducting experiments;

fundamentals of design of chemical-technological enterprises and productions;

fundamentals of automation of production management;

fundamentals of the layout of technological equipment;

fundamentals of a unified system of design documentation

Must be able to:

apply the acquired knowledge, skills and abilities in subsequent professional activity in the design and operation of various objects of oil and gas field systems;

plan work in the field of scientific and technical activities;

conduct technical and technological analysis, comprehensively substantiate the decisions taken and implemented;

to choose the most efficient resource- and energy-saving technologies for solving the problems of hydrocarbon preparation, to carry out calculations of technological equipment in the field of field preparation of oil, gas and water

## **COLLECTION, PREPARATION AND TRANSPORTATION OF HYDROCARBON GAS**

CODE - CHE470

CREDIT - 5 (2/0/1/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

Graduates' readiness for production, technological and project activities that ensure the modernization, implementation and operation of equipment for oil and gas production, transportation and storage

Graduates' readiness for organizational and managerial activities for making professional decisions in interdisciplinary areas of modern oil and gas technologies using the principles of management and management

The readiness of graduates to be able to substantiate and defend their own conclusions and conclusions in classrooms of varying degrees of interdisciplinary professional training

Graduates' readiness for self-study and continuous professional self-improvement in conditions of autonomy and self-government

### **BRIEF DESCRIPTION OF THE COURSE**

Gas transportation and storage of hydrocarbon resources are among the components of the high-tech process of its extraction and processing. This is an extremely dangerous raw material, so when it is in transit and stored, it is worth adhering to certain safety requirements. Special rules for working with the substance apply at enterprises. Transportation of oil and gas is an extremely dangerous process of mineral supplies directly from wells, fields to consumer organizations.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

As a result of mastering the discipline, the student should know:

- principles of classification and nomenclature of organic compounds; structure of organic compounds; classification of organic reactions; properties of the main classes of organic compounds; basic methods of synthesis of organic compounds;

- the main stages of qualitative and quantitative chemical analysis; theoretical foundations and principles of chemical and physico-chemical methods of analysis - electrochemical, spectral, chromatographic; methods of separation and concentration of substances; methods of metrological processing of analysis results;

- basic concepts and relations of thermodynamics of surface phenomena, basic properties of dispersed systems.

### **TECHNOLOGICAL PROCESSES OF OIL PRODUCTION INTENSIFICATION**

CODE - CHE471

CREDIT - 5 (2/0/1/3)

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**The purpose of the discipline:** this discipline is intended for professional training of specialists in the chemical technology of organic substances. The assimilation of this course contributes to a deep understanding by students of the technological processes of oil production intensification, the acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

**Course objectives:** To provide students with theoretical knowledge and practical skills necessary for a deep understanding by students of technological processes of intensification of oil production, acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

### **BRIEF DESCRIPTION OF THE COURSE**

Intensification is an increase in the rate of oil production. MIDN - tools (technological) that can lead to the intensification of oil production. Indicators of intensification – accumulated production, KIN. It is possible to determine whether the methods used were intensifying or MUNI only after the fact. The intensification of oil production occurs as a result of the impact on the near-well zone of the formation; and as a result of the impact on remote zones of the formation or areas not previously involved in development.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The study of this discipline will allow the student to correctly apply the acquired knowledge to lay the scientific foundations of technological processes for the intensification of oil production; rules for the design of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

## **FUNDAMENTALS OF PETROCHEMICAL SYNTHESIS**

CODE – CHE453

CREDIT – 5 (2/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main purpose of the course is that this discipline is intended for the professional training of specialists in the chemical technology of organic substances. The assimilation of this course contributes to the study of the basics of petrochemical synthesis, the acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

#### **Course objectives:**

To provide students with theoretical knowledge and practical skills necessary for a deep understanding of the basics of petrochemical synthesis by students, the acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

### **BRIEF DESCRIPTION OF THE COURSE**

The course briefly discusses modern industrial processes for the production of various hydrocarbons, their halogen- and oxygen-containing derivatives as raw materials for petrochemical processes. The processes of obtaining detergents, as well as the most important polymers used in the production of plastics and synthetic fibers are considered. Basic information on economics, safety and environmental protection is given for all processes.

The course is intended for students of educational institutions specializing in "Chemical technology of oil and gas". It is of interest to teachers of secondary specialized educational institutions, as well as to engineering and technical workers of oil refining and petrochemical enterprises.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The study of this discipline will allow the student to correctly apply the acquired knowledge to lay the scientific foundations of petrochemical synthesis; rules for the design of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

## **FUNDAMENTALS OF PHYSICAL AND CHEMICAL ANALYSIS OF OIL REFINING PRODUCTS AND PETROCHEMISTRY**

CODE – CHE472

CREDIT – 5 (2/1/0/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main purpose of the course is that this discipline is intended for the professional training of specialists in the chemical technology of organic substances. The assimilation of this course contributes to the study of the basics of physico-chemical analysis of oil refining products and petrochemistry, the acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

#### **Course objectives:**

To provide students with theoretical knowledge and practical skills necessary for a deep understanding by students of the basics of physico-chemical analysis of petroleum products and petrochemistry, acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe oil production technology and engineering calculation skills.

### **BRIEF DESCRIPTION OF THE COURSE**

The structure (structure) of oils and oil fractions as dispersed systems (Vat) is considered, methods of analysis of their dispersed structure and basic physico-chemical properties are described. The concept of the occurrence of extreme Vat conditions under the influence of external influences is described, which is fruitfully used to optimize the processes of oil production, transportation and refining, regulation of operational and environmental properties of petroleum products.

Designed for scientific engineers of oil refineries, it will be useful for students of oil and gas universities.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The study of this discipline will allow the student to correctly apply the acquired knowledge to lay the scientific foundations of the physico-chemical analysis of oil refining products and petrochemistry; rules for the development of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

## **TECHNOLOGY OF PRIMARY PROCESSING OF OIL AND GAS I**

CODE – CHE473

CREDIT – 5 (1/1/1/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline: this discipline is intended for the professional training of specialists in the chemical technology of organic substances. The assimilation of this course contributes to a deep understanding of the technology of primary oil and gas processing by students, the acquisition of theoretical knowledge necessary for the development of economically feasible and environmentally safe technology for the production of organic substances and engineering calculation skills.

### **BRIEF DESCRIPTION OF THE COURSE**

The purpose of studying the course "Technology of primary processing of oil and gas I" is to familiarize students with the general patterns and prospects for the development of technology for the preparation and primary processing of hydrocarbon raw materials and polymer materials.

**Expected results:** The study of this discipline will allow the student to correctly apply the knowledge gained to lay the scientific foundations of the technology of primary oil and gas processing; rules for the development of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

## **STORAGE OF HYDROCARBON RAW MATERIALS**

CODE – CHE469

CREDIT – 5 (1/0/1/2)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the discipline is to form students' knowledge, skills and abilities that ensure qualified participation in the field of operation of transport facilities and storage of hydrocarbon raw materials. The study of the main provisions on the storage and transportation of hydrocarbon raw materials arising during the operation of oil and gas pipelines with oil and petroleum products, which are further developed and deepened within the profile.

### **BRIEF DESCRIPTION OF THE COURSE**

Summary of the discipline: Types of transport. Transportation of hydrocarbons in railway tanks, general concepts, regulatory framework. Types of tanks, construction, equipment, nomenclature. Draining and filling of railway tanks. Automobile transport UV. Transportation of hydrocarbons in tank trucks,



general concepts, regulatory framework. Water transport UV. Tankers for the transportation of HC general concepts, regulatory framework. UV pipeline transport. Hydraulic calculation of liquefied gas pipelines. Technical and economic indicators of storage facilities.

In the process of mastering this discipline, the student forms and demonstrates competencies that allow: to compile and apply technical documentation related to professional activity in accordance with current regulatory legal acts; demonstrates the ability to summarize information and enter it into the forms of layouts in accordance with current regulations; demonstrates methods of adjusting technological processes during construction, repair and operation of equipment for transportation and storage of hydrocarbon raw materials

**Expected results:** The study of this discipline will allow the student to correctly apply the acquired knowledge to bookmark scientific areas of operation of transport facilities and storage of hydrocarbon raw materials; rules for the design of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

## **TECHNOLOGY OF ORGANIC AND PETROCHEMICAL PRODUCTION**

CODE – CHE634

CREDIT – 5 (2/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the study: To form a set of students' knowledge about the methods and means of conducting production processes, scientific thinking about understanding the logical connection between the chemical structure and reactivity of organic compounds, the processes of their processing, leading to a radical change in their structure, composition and properties.

### **BRIEF DESCRIPTION OF THE COURSE**

Summary: The study of the processes of processing hydrocarbon raw materials in which chemical and physico-chemical phenomena prevail, leading to a radical change in the properties and structure of substances. Mastering the technology of obtaining the main products of organic and petrochemical synthesis (paraffins, olefins, aromatic hydrocarbons, methanol, synthesis gas, monomers for polymerization and polycondensation of polymer materials.

**Expected results:** Creation of the basics of theoretical training for students to solve practical problems in the field of basic organic and petrochemical

production. To know the properties, applications and production processes of the most important organic substances, as well as the main classes of polymer materials, to demonstrate independently and creatively work with literary sources, write abstracts, develop technological schemes or their components not given in textbooks. Apply the acquired knowledge in economics, everyday life and solving problems of environmental protection and protection.

### **FUNDAMENTALS OF ENTERPRISE DESIGN**

CODE – CHE560

CREDIT – 5 (2/0/1/3)

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#### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the study: The main provisions of the organization of design work for the construction of new enterprises of reconstruction or technical re-equipment of existing enterprises of food industries are considered. This course is designed to introduce the basic concepts of chemical engineering for bachelors. Instilling students with the ability to study educational literature independently

#### **BRIEF DESCRIPTION OF THE COURSE**

Summary: The course describes the main structural and architectural elements of buildings. The rules of development on the design of technological schemes, drawings of plans and sections of industrial enterprises of the food industry are given.

Recommendations on the development of master plans of enterprises and rules for their design are given

**Expected results:** The study of this discipline will allow the student to correctly apply the rules of development on the design of technological schemes, drawings of plans and sections of industrial enterprises of the food industry; apply the master plans of enterprises and the rules of their design; demonstrate the knowledge gained for the statistics of methods for processing experimental data;

### **OIL AND GAS RECYCLING TECHNOLOGY II**

CODE – CHE475

CREDIT – 5 (2/0/1/3)

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#### **PURPOSE AND OBJECTIVES OF THE COURSE**

Purpose of study: this discipline is intended for professional training of specialists in the chemical technology of organic substances. Mastering this course contributes to students' deep understanding of chemistry and technology of oil and gas recycling technology, acquisition of theoretical knowledge necessary for the

development of economically feasible and environmentally safe technology for the production of organic substances and engineering calculation skills.

### **BRIEF DESCRIPTION OF THE COURSE**

**Summary:** Technological processes for obtaining secondary oil refining, technologies for processing hydrocarbon raw materials; basic methods of oil and gas processing; basic principles of the technological process and hardware design; technological and structural calculation of equipment..

**Expected results:** The study of this discipline will allow the student to correctly apply the acquired knowledge to lay the scientific foundations of oil and gas recycling technology; rules for the design of technological schemes, drawings of plans and sections of industrial enterprises; apply master plans of enterprises and rules for their design; demonstrate the skills of technological and structural calculation of equipment; the ability to work with regulatory and technical documents.

### **CHEMICAL PROCESSING OF HYDROCARBON GAS**

CODE – CHE474

CREDIT – 5 (2/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the study: determined by the didactic principles of higher education: scientific, accessible, humanistic, the connection of theory with practice, take into account the professionally significant qualities of a specialist in this profile and are based on the methodological laws of the science of "Chemical reactors"

### **BRIEF DESCRIPTION OF THE COURSE**

Primary processing of hydrocarbon gases. Preparation of gases for processing. Purification of gases from mechanical impurities Purification of gases from chemical impurities (hydrogen sulfide, carbon dioxide, carbon disulfide, mercaptan, carbon dioxide) Production of sulfur gas by the Claus method Gas drying. Separation of hydrocarbon gases. Extraction of liquid hydrocarbons by low-temperature separation (NTS) Production of unstable gasoline by compression method, stabilization of gas gasoline - gas fractionating plants Low-temperature separation processes: Low-temperature condensation (NTC) Low-temperature absorption (NTA) Low-temperature rectification (NTR) Low-temperature adsorption (NTAD) Cryogenic production of helium from natural gases. Stabilization and processing of gas condensates.

**Summary:** General characteristics of oil and gas. Proven reserves, production and consumption of oil and gas in the leading countries. Hypotheses of the origin of oil. Basic physical and chemical properties of oil. The composition of oil.

Alkanes. Cycloalkanes (cyclanes). Arenas. Resinous-asphaltene substances. Heteroelements. Heteroatom-containing compounds. Sulfur-containing compounds. Preparation of oil for processing and primary processing Secondary processing of oil. Oil refining options.

**Expected results:** The student should know: - the component composition of oil and other hydrocarbon systems of natural and man-made origin; - physico-chemical properties of the main classes of hydrocarbons and heteroatomic compounds of oil; - methods of separation of multicomponent oil systems; - methods of oil and petroleum products research; - properties of oil as a dispersed system; - the main types and principles of classifications of oil, oil dispersed systems, gases; - hypotheses of the origin of oil; - the main processes of oil and gas processing

Must be able to: - use the principles of classification of oil and gas systems; - apply knowledge about the composition and properties of oil and gas in the relevant calculations; - conduct standard experiments, process, interpret the results and draw conclusions; - determine the basic physical and chemical characteristics of substances; - predict the behavior of oil and gas in various thermodynamic conditions, based on knowledge of their composition and physico-chemical properties; - formulate research goals and objectives; - develop theoretical prerequisites, plan and conduct experiments; - analyze the results obtained, compare them with literary or production data.

## **CATALYSTS AND CATALYTIC PROCESSES OF PETROCHEMISTRY**

CODE – CHE463

CREDIT – 5 (2/0/1/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

**The purpose of the study:** - study of the theoretical foundations of the most important catalytic processes of petrochemical synthesis; - demonstration of important areas of practical application of catalytic processes in the petrochemical industry; - practical reinforcement of knowledge of the basic laws of heterogeneous catalysis; - preparation of students for independent work in the development of new catalytic processes and the operation of existing catalytic technologies.

### **BRIEF DESCRIPTION OF THE COURSE**

The course is designed for general professional training of specialists in petrochemistry, mastering the scientific foundations of the concept, theory, principles and applications of catalysis, developing the competence of a master in the field of industrial catalysis, forming scientific thinking among undergraduates, in particular, analyzing and generalizing the principles of catalytic technologies of

petrochemistry. Mastering this course develops and strengthens practical skills of system analysis of the laws of chemical and technological processes, in solving problems of environmental protection and protection.

**Expected results:** the student should know: - the importance of catalytic processes in the creation of industrial technologies; - theoretical foundations of the most important catalytic processes in the petrochemical industry; Program of the discipline "Catalytic processes in petrochemistry"; - basic principles of the formation of industrial processes; - the essence and regularities of heterogeneous catalysis; - new promising directions for the development of catalytic processes in industry.

2. must be able to: - navigate the issues of creating technological schemes of industrial catalytic processes; - to understand the main types of catalytic systems of industrial importance.

## **CORROSION, TYPES OF CORROSION OF PETROLEUM EQUIPMENT AND CORROSION INHIBITORS**

CODE - CHE411

CREDIT – 5 (2/1/0/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the study: The purpose of teaching the course "Corrosion, types of corrosion of oil equipment and corrosion inhibitors" is to form specialized knowledge and skills with a high degree of their understanding in the sections of the course, helping to analyze and solve theoretical and practical problems.

**Course objectives:** instilling students with the ability to independently study educational literature, conduct theoretical, probabilistic and statistical analysis of applied corrosion problems; develop logical thinking and increase the general level of corrosion and its control.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Corrosion, types of corrosion of oil equipment and corrosion inhibitors" includes sections: corrosion theory, elements of corrosion theory and corrosion control and is a logical continuation of the discipline in the specialty profile.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The student

should know:

- corrosion theory;
- theory of the theoretical basis of the corrosion process;
- methods of combating it in the oil fields;

must be able to:

- apply the acquired skills to solve corrosion issues;
- use statistical methods for processing experimental data;

## **PREPARATION AND APPLYING OF RESERVOIR AND FRESH WATER FOR INJECTION INTO THE RESERVOIR**

CODE - CHE465

CREDIT – 5 (2/0/1/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the course is to consider the main provisions for creating new schemes clarification of turbid waters by coagulation is carried out in order to remove very small suspended particles that practically do not precipitate under the influence of gravity.

**Course objectives:** This course is designed to familiarize students with the basic concepts of chemical engineering for bachelors. instilling students with the ability to study educational literature independently.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Preparation and use of reservoir and fresh water for injection into the reservoir" includes sections: 1) clarification of turbid waters by coagulation; 2) decarbonization; 3) de-ironing; 4) inhibition.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

The student

should know:

- the theory of oil preparation in the fields;
- the theory of the theoretical basis of terbovaniya predyavlyaemye to reservoir waters;

must be able to:

- apply the acquired skills to solve issues on systems of preparation and injection of water into productive formations;
- use statistical methods for processing experimental data;

## **TECHNOLOGY FOR THE PRODUCTION OF AROMATIC HYDROCARBONS**

CODE – CHE610

CREDIT – 5 (2/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**



The purpose of teaching the course is to study the basic patterns of chemical reactions in the production of aromatic hydrocarbons from petroleum raw materials;

- formation of an understanding of the basic principles of the technological process and its hardware design;
- acquisition of skills in technological and structural calculation of equipment.

### **BRIEF DESCRIPTION OF THE COURSE**

The content of the discipline assumes the study of the basic patterns of chemical reactions in the processes of production of aromatic hydrocarbons from petroleum raw materials, consideration of the technology of separation and extraction of aromatic hydrocarbons from concentrate, processes of mutual transformation of aromatic hydrocarbons. Familiarization with the methods of extraction and extractive rectification of arenes from the reforming catalysate.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

As a result of mastering the discipline, the student must:

- \* to know the essence and social significance of their profession; the physico-chemical basis of the processes occurring in the production of aromatic hydrocarbons from oil fractions, the main methods of isolation and concentration of individual arenes

- \* be able to conduct technological calculation of the production processes of arenes from oil fractions, evaluate the technical and economic efficiency of the production of arenes.

- \* possess methods for determining optimal and rational operating modes of equipment, methods for calculating technological standards and parameters of the uranium concentration process, selection of technological equipment

### **EQUIPMENT OF AN OIL AND GAS ENTERPRISE**

CODE – CHE460

CREDIT – 5 (2/0/1/3)

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the study of the discipline: study of the composition of the project( working draft), design and estimate documentation, the basis for its development, the organizational foundations of the design of an oil and gas enterprise, study of the structures, the principle of operation of the main and special equipment for the production and processing of oil and gas enterprises, familiarization with its main components and details, development of methods and features of calculating the strength of elements of apparatuses and machines.

### **BRIEF DESCRIPTION OF THE COURSE**

Summary: CTP, CTS, synthesis and analysis of CTS. Fundamentals of design. Development of the technological part of the enterprise project and the technological part of the installation project. Hardware and technological design of typical organic synthesis processes. Fundamentals of technological calculations of equipment and equipment of chemical-technological processes. Design of objects of general factory economy. The general plan of the enterprise. Energy supply of the enterprise. Protection of the natural environment from pollution by harmful emissions of the enterprise. Requirements for the design of chemical equipment. Classification of equipment. Materials used for the manufacture of equipment. Design, technical projects, technological, mechanical calculations. Calculation of device elements. Calculation of the housings of thin-walled cylindrical apparatuses on the effect of internal and external pressure of the medium. Bottoms of various structures and their application areas, their strength calculations. Stability of the devices. Determination of wind loads on the device. Loads on the foundation and the stability of the device. Basic devices. Heat exchangers. Tubular furnaces. Mass transfer devices. Rectification, absorption, and desorption columns. Reaction apparatuses of basic organic and petrochemical synthesis.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

Expected results: In the course of studying the discipline, students also gain skills in using scientific and technical and reference literature, determining the technical characteristics of devices and equipment and evaluating their technical and economic efficiency.

### **TECHNOLOGY OF PRODUCTION AND PROCESSING OF POLYMERS**

CODE – CHE638

CREDIT – 3 (1/0/1/2)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The discipline "Chemical technology of polymer production and processing" aims to study the methods of technological processes for obtaining the main types of polymerization, polycondensation and chemically modified polymers and polymer materials based on them.

### **BRIEF DESCRIPTION OF THE COURSE**

Summary: Introduction. Basic concepts and definitions of polymer chemistry and physics: structure and classification of polymers Methods for obtaining the main types of polymers Chemical transformations of polymers Structure of

polymer materials Phase and physical states of polymer materials Basic physical and mechanical properties of polymers Polymer-low molecular weight liquid system. Polymer mixtures

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

As a result of studying this discipline, students should have: an idea of: modern technologies for the production and processing of polymers, know: the physico-chemical basics of polymer processing, basic and specific technological schemes for the production of various types of polymer materials in industry and in the laboratory, their applications should be able to: recognize polymers, as well as industrial methods for obtaining polymers, demonstrate the chemical process using instruments and experiments, determine the properties of polymers, identify the relationship 4 between the structure and properties of polymers

### **ENVIRONMENTAL ASPECTS OF PETROCHEMICAL PRODUCTION**

CODE – CHE477

CREDIT – 3 (1/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

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.

### **BRIEF DESCRIPTION OF THE COURSE**

Summary: Environmental problems of processing of hydrocarbon systems. Basic concepts of the ecology of processing of hydrocarbon systems. Explosions and fires, their forecasting. Ways to control fire and explosion safety in the processing of hydrocarbon systems. Monitoring of the environment during the processing of hydrocarbon systems. Monitoring of the water basin. Pollution and monitoring of the lithosphere. Biological monitoring of the environment. Development of automated monitoring systems for oil refining and petrochemical enterprises. Production of hydrocarbon systems with improved environmental characteristics. Environmental pollution during the operation of motor fuels. Technological processes of processing of hydrocarbon systems that improve the environmental quality of gasoline. Jet fuel. Diesel fuels with improved environmental performance. Fuel boilers with improved environmental characteristics. Management of environmental quality, industrial and environmental safety in the processing of hydrocarbon systems.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

Expected results: formation of the students ' environmental tasks for processing 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 environmental quality management.

The student should know: environmental problems of processing of hydrocarbon systems, basic concepts of ecology of processing of hydrocarbon systems, environmental monitoring during processing of hydrocarbon systems, features of environmental impact of products of combustion of hydrocarbon systems.

The student should be able to: develop environmental and promising areas of hydrocarbon processing, ways to improve technology, control and management systems, use new and advanced production methods with the lowest harmful emissions, basic overall dimensions, equipment parameters and the ability to choose the type, according to catalogs.

### **PROCESSING OF HYDROCARBON GAS INTO FUEL COMPONENTS AND VALUABLE CHEMICAL PRODUCTS**

CODE – CHE476

CREDIT – 5 (2/0/1/3)

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

Formation of disciplinary competencies designed to lay the scientific foundations for the subsequent study and creation of principles of resource- and energy-saving technologies of the gas processing industry.

### **BRIEF DESCRIPTION OF THE COURSE**

Natural gas and other hydrocarbon gases used to produce heat, steam, and electricity are called energy fuels. It is known that the efficiency of power plants that use natural gas as fuel is 60-70% (new generation boilers have an efficiency of more than 90%), liquid fuel is 30-40%, and solid fuel is 20-30%. When using hydrocarbon gases as an energy fuel, not only a technical and economic effect is achieved, but also a significant environmental effect, since emissions of harmful combustion products into the atmosphere are sharply reduced.

### **KNOWLEDGE, SKILLS, SKILLS AT THE END OF THE COURSE**

As a result of mastering the discipline , the student must:

\* know the scientific basics of chemistry, kinetics and technology of natural and liquefied petroleum gas processing processes;

\* be able to navigate in the development of energy- and material-saving environmentally friendly technological productions; rationally search for and use scientific and technical information related to the technology of processing of hydrocarbon gases; navigate in educational, monographic, reference and journal literature in this field.

\* possess the skills of technological and structural calculation of equipment of oil and gas processing and petrochemical industries.

### **PREPARATION AND WRITING OF THE THESIS (PROJECT)**

CODE – ECA003

CREDIT - 6

PRE-REQUISIT - NO

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main purpose of the thesis is to develop professional skills of scientific research.

As the main tasks assigned to the student when writing a thesis, the following can be distinguished: - consolidation and deepening of theoretical and practical knowledge and their application to solve specific problems; - familiarity with the methodology and methods of scientific research; - acquisition of skills to work with various types of sources, mastering the principles of their scientific analysis and generalization, external and internal criticism, methods of extraction, comprehension, use of complete and objective information contained in them; – formation of skills for independent solution of actual scientific and practical tasks; - mastering the techniques of logical, clear and convincing presentation of their thoughts in writing; - formation of creative, innovative approaches to the organization and conduct of scientific research and focus on the practical development of the results of scientific activity– - identification of the degree of readiness of the student for independent work (including scientific) in the conditions of modern development of science and society.

### **BRIEF DESCRIPTION OF THE COURSE**

A thesis is an educational document performed by a student according to the curriculum at the final stage of training specialists at the university. It accumulates the student's knowledge for the entire period of study, confirms his willingness to independently solve theoretical issues and practical tasks and largely indicates the level of mastery of the profession.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

As a result of writing a thesis, a student should be able to: - independently work with sources and literature; - formulate the purpose, objectives of the work,

substantiate the relevance of the chosen topic, the structure of the work; - make scientifically sound conclusions based on the studied material; - possess research methods; - clearly and consistently express their thoughts in writing, correctly use scientific terminology; - design the work in accordance with the requirements for scientific research.

### **DEFENSE OF THE THESIS / THESIS PROJECT**

CODE - ECA103

CREDIT - 6

PRE-REQUISIT - no

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The objectives of the implementation and defense of the thesis (project) are:

- systematization, consolidation and expansion of theoretical knowledge and practical skills in the specialty and their application in solving specific scientific, technical, economic and production problems, as well as cultural tasks;
- development of skills in conducting independent work and mastering the methodology of scientific research and experimentation in solving developed problems and issues;
- finding out the student's readiness for independent work in the conditions of modern production, science, technology, culture, as well as the level of his professional competence.

### **BRIEF DESCRIPTION OF THE COURSE**

Thesis (project) is a generalization of the results of independent study and research of an urgent problem in the field of chemical engineering and engineering

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

- the ability to independently collect scientific and technical information, conduct experimental work and the necessary calculations to achieve specific goals of the thesis / project and solve engineering problems in the field of technology of organic and inorganic substances.
- skills to summarize the results obtained in the appropriate text, tabular and graphic forms that meet the requirements of the standards;
- the ability to draw appropriate conclusions and conclusions on the results obtained, indicate their novelty and practical significance;
- skills in presenting the results of the thesis / project in the form of a presentation, using PowerPoint slides, and orally.





«Мұнай-газ-химия өнімдерін өндірушілер мен тұтынушылар Қауымдастығы» ЗТБ  
ОЮЛ «Ассоциация производителей и потребителей нефтегазохимической продукции»  
«Petrochemical Products Producers and Consumers Association» ALE  
010000, Республика Казахстан, город Нур-Султан, район Есиль, улица Е10, дом 17/10

№ 03-21/3  
«27» октября 2021 г.

### Рецензия

На основную профессиональную образовательную программу высшего образования квалификации выпускника «бакалавр» в области инженерии и инженерного дела по образовательной программе 6В07117 «Химическая технология нефтегазохимической продукции» Казахского Национального Исследовательского Технического Университета имени К.И. Сатпаева.

Основная профессиональная образовательная программа разработана Казахским Национальным Исследовательским Техническим Университетом имени К.И. Сатпаева и основывается на государственном образовательном стандарте для высшего профессионального образования в соответствующей области.

#### *Общая характеристика образовательной программы.*

В данной ОП учитываются потребности регионального рынка труда, требования государственных органов и соответствующие отраслевые требования. Нефтегазовая отрасль является одной из основ экономики Казахстана. Она включает в себя совокупность взаимосвязанных процессов и производств от геологоразведочных работ до переработки нефти и газа, и их реализации. В этом производственном процессе обособлено стоит переработку нефти и газа, поскольку по мере продвижения по технологической цепочке происходит быстрое наращивание добавленной стоимости (нефтегазохимические продукты высоких переделов).

#### *Оценка структуры образовательной программы (характеристика учебного плана).*

Структура образовательной программы включает в себя учебную программу, содержание дисциплин и результаты обучения и другие материалы для обеспечения качественного образования студентов.

#### *Оценка соответствия содержания дисциплин компетентности модели выпускника (перечень, содержание аннотированных программ дисциплин).*

По содержанию образовательная программа 6В07117 «Химическая технология нефтегазохимической продукции» соответствует требованиям МОН РК в части профессиональной деятельности выпускников, набора компетенций: общекультурных, общепрофессиональных и профессиональных компетенций (по видам профессиональной деятельности), структуре программы (обязательной и вариативной частей дисциплин), учебной, производственных и преддипломных практик. В ОП приведены аннотации



рабочих программ учебного плана, где отражены сведения о разработчике, наборе компетенции, формируемых при изучении данной дисциплины и ее связь с другими дисциплинами.

**Оценка соответствия тематики практических, лабораторных (а также курсовых, выпускных квалификационных работ требованиям подготовки выпускника по образовательной программе).** Тематика практических и лабораторных занятий, курсовых и выпускных квалификационных работ соответствуют профилю направления подготовки и требованиям МОН РК по образовательной программе 6В07117 «Химическая технология нефтегазохимической продукции», а также видам профессиональной деятельности, по которым готовятся выпускники, освоившие программу бакалавриата.

**Соответствие содержания образовательной программы современному уровню развития науки, техники и производства.**

ОП позволяет подготовить бакалавра, обладающего компетенциями, соответствующими виду профессиональной деятельности: производственно-технологической, организационно-управленческой и научно-исследовательской в соответствии с современным уровнем развития науки, техники и производства.

**Рекомендации, замечания.**

Реализация ОП при обучении студентов по направлению подготовки бакалавров в области инженерии и инженерного дела по образовательной программе 6В07117 «Химическая технология нефтегазохимической продукции» позволит выпустить достаточно эрудированных, профессиональных и компетентных специалистов достойных занимать любые должности в области производства и переработки нефтегазохимической продукции, что позволяет рекомендовать ее к исполнению.

**Закключение.** Основная профессиональная образовательная программа понаправлению подготовки бакалавров в области инженерии и инженерного дела по образовательной программе 6В07117 «Химическая технология нефтегазохимической продукции» отвечает основным требованиям Министерства Образования и Науки Республики Казахстан, работодателей предприятий нефтегазохимической отрасли и способствует формированию общекультурных, общепрофессиональных и профессиональных компетенций у бакалавров в соответствии с современным уровнем развития науки и техники.

Генеральный директор  
Нефтегазохимической ассоциации



Толкимбаев Г.А.