**REPUBLIC OF KAZAKHSTAN**
**MINISTRY OF EDUCATION AND SCIENCE**

**THE S. TORAGYROV PAVLODAR STATE UNIVERSITY**

**Approved by the Academic council of the university**
Record No. 4 as of «29» 11 2016
Chairman of Academic council
_____ Orsariyev A.A.
(signature) (name)

# MODULAR EDUCATIONAL PROGRAMME

specialty **5B072100 –CHEMICAL TECHNOLOGY OF ORGANIC SUBSTANCES**

## OIL AND GAS REFINING

Level of educational program: **Bachelor degree**

Developers:

Head of Group for educational program development

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## 1 Educational Program Passport

Graduates of this educational program «Oil and Gas Refinery» is awarded the academic degree of "Bachelor of engineering and technology" by specialty 5B072100 - Chemical technology of organic substances.

**The aim of the educational program:**

*Formation of common cultural competencies: This includes* social interaction competencies, self-organization and self-management. For instance: constructing inner senses, intellectual enhancements, cultural and moral relations, scientific senses and knowledge, humanitarian, general professional and special focused knowledge.

*General professional and special focused competencies:*

- acquiring theoretical knowledge and practical skills and methods for adequate analysis, solving technical tasks of designing oil and gas complexes, conducting research in the field of studying synthesis of materials and their properties;
- ability to employ modern information technologies and automation designing systems and information resources in solving professional tasks;
- ability to analyze and comprehend development tendencies in oil and gas technologies;
- Teamwork skills, professional ethical responsibilities, an ability to work and communicate with different specialists, self-enhancement of professional knowledge and skills.

Graduates of chemical technology of organic substances are expected to gain the following ***core competences*** in the field of:

1) *native language* (Kazakh/Russian language)

**Graduates** are expected to experience a number of language skills: conversation, description, presentation skills including development of scientific and professional speech: active, generalized, three-dimensional forming of skills and abilities in the field of scientific and professional speech. S/**He should be able** to develop educational and professional presentations. They are to develop skills that allow them to professionally manage their native language skills: reading, listening, writing, speaking and note-taking.

*2) foreign languages*

Graduates should have basic communication skills in English. They should be able to communicate effectively; this says they should understand, express and interpret concepts, thoughts, feelings, facts and opinions both in oral and written forms. These skills extends to allow students to communicate in an appropriate range of other social and cultural contexts; for example: in education and training, at work, at home and at leisure. This aspect of the course is intended to equip students with other skills such as mediation and intercultural understanding and the ability to read technical documentation and professional literature in English and to improve foreign language skills.

*3) fundamental mathematical, natural sciences and technical training*

This aspect of the course aims at providing graduates with abilities to develop and apply mathematical thinking. This will allow them to solve problems, to develop their

critical thinking (logic and spatial intelligence). This competency extends to enhance students' abilities to understand, present and report on their educational and professional activities, i.e., formulas, models, constructs, graphs, tables. These skills should allow graduates to use their knowledge and experience to explore and explain the world, to identify problems and solutions supported by logical evidence.

*4) computer training*

After completing the course, graduates should be confident and able to use models and technologies for work, leisure and communication. They should be equipped by IT skills to read, analyze, reproduce, present and store different types of digital data. Students are to learn how to use a number of computerized models, these to allow them to enhance their knowledge and skills as chemical engineers who are able to fit in the work place.

*5) academic training*

Graduates of chemical technology of organic substances should gain a suitable level of knowledge and practical skills in the theoretical foundations of synthesis of organic compounds, organic chemistry of cyclic compounds, oil and gas chemistry, technology of organic and petrochemical synthesis, machinery and modern equipment of oil and gas refineries and basics of design required for professional work.

*6) social training*

On the social aspect, graduates should be able to conduct a business conversation. They should have the ability and skills to live and work in groups, in the family, in society, in the world. Their critical thinking skills should allow them to accept the other and deal with oppositions positively. Importantly, they should be able to comply with the rules of social and business ethics, own ethical and legal standards of conduct.

*7) business and economic training*

The business aspects of the course are intended to allow students to be able to understand, analyze and respond to economic and business queries. In addition, to equip them with decision-making tools and skills, so they are able to compete in the dynamics of contemporary business and economic world. Graduates should have understanding of different aspects of business: marketing, management, human resources, economics and entrepreneurship. They should know how and where to find a worthy place in the niche market relations. Importantly, they should be prepared for changes in the type and nature of their professional activities. Furthermore, students should know the basics of the legal system and legislation of Kazakhstan and the trend of social development.

*8) cultural training*

Graduates should know the traditions and culture of Kazakhstan people. They should understand and realize the importance of the creative presentation and expression of ideas. They should appreciate experiences and emotions through various means. In addition, graduates should be tolerant to the traditions and culture of people of other countries. This should equip them with ethical codes that helps in preventing domestic racism, xenophobia, extremism and countering them. These aspects should prepare students in ways that prevent them from being subject to prejudices, including the chauvinistic nature; has high spiritual qualities, developed as an intelligent person.

*9) general competences*

By undertaking this course, students will acquire the skills of the general laws of chemical-technological processes and methods of their optimization. They should be able to match technical and economic indices of production taking into account the scientific advances in the chemical industry. They should have the ability to evaluate the strengths and weaknesses of a technological scheme, carried out a comparative analysis of the technological methods of processing raw materials. These skills should allow graduates to manage technological processes, taking into account economic and environmental priorities in the choice of methods of processing. They should learn how to undertake calculations to determine the technological regime parameters and indicators of the effectiveness of chemical-technological process and aids.

Graduates of specialty 5B072100 – "Chemical technology of organic substances" are expected to acquire the following ***special competences***:

1. **Foundations of Information Systems;** this includes: international and domestic standards on information technology, data protection, and other regulations, internal and project documentation, information systems paradigm.

2. **Chemical sciences;** this includes: the structure of atoms and molecules theory, types of chemical interaction of the substances, the structure of matter, composition, structure, methods of synthesis and chemical properties of simple substances and chemical compounds, the basic concepts and laws of organic, analytical and physical chemistry, the specific properties of organic compounds, safety at conducting syntheses.

**3. Technology of processing of hydrocarbons;** this includes: guidelines and the scientific basis of preparation of oil and gas for refining processing, principles of technological processes of processing of hydrocarbon feed, polymer-based technology and the production of plastics based on them, modern production processes, providing valuable organic compounds on the basis of primary and secondary processing of oil products, gas and solid fuels, high-octane components of gasoline synthesis gas from the catalytic cracking.

4. **Processes and Equipment of Chemical Production;** this includes: the general laws of chemical-engineering processes, analytical methods and ways of optimization of chemical-technological processes and systems, to know the basic types of equipment, the sequence of technological processing of chemical plants, the selection criteria for chemical devices and accessories based on occurring processes.

5. **Technology of hydrocarbons processing;** this includes: basic knowledge in chemistry and the technology of oil and gas, polymers; principles of technological equipment and designing technological units of production process; and also processing of straight-line schemes of organic substances; principles of non-waste and eco-friendly processes in oil refinery.

# 2 Content of the educational program

| The name of the module | Expected results of training | Volume | | Semester | Module components | | | | | | | Formed competences |
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| | | KZ | ECTS | | Discipline code | Name of the module components (disciplines, practics, etc.) | Discipline cycle (common compulsory discipline, basic discipline, specialized discipline) | Group (A, B, C) | Compulsory component (CC)/ Optional component (OC) | Quantity of credits | Form of control | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| **Common modules** | | | | | | | | | | | | |
| Social and Ethical Competence | **Knowledge and understanding of:**<br>-important and fundamental issues of the political, economic, social and cultural development of our state from the beginning of 20th century to date;<br>- dynamics, driving forces, tendencies of development of modern history of Kazakhstan;<br>- key international and Kazakhstani literature on modern history of Kazakhstan with ability to conduct a critical analysis of this literature;<br>- wide range of historical sources and their use as evidence in arguments;<br>- Understanding of the problematic nature of historical interpretation and evidence.<br>- fundamental philosophical theories and methods applied in the study of human nature and society;<br>- fundamental problems of philosophy and the peculiarities of their formulation and solution;<br>- main stages of development of the world's and Kazakh philosophy<br>- social functions of physical culture and sport;<br>- basics of life safety and actions in extreme situations.<br>**Applying the knowledge and understanding –ability to:**<br>-critically use a range of sources to generate an interpretation of the significance of a site or object in its historical context;<br>- apply critical and empathetic reading and use of texts or other source materials;<br>- compare and contrast different theoretical positions in verbal and written forms; | 8 | 13 | 1 | | Modern History of Kazakhstan | CCD | | CC | 3 | SE | - applying the basic principles of historical knowledge in solving the important and problematic situations in the professional sphere;<br><br>- a critical awareness of the relationship between current events and processes and the past;<br><br>- critical awareness of and respect for points of view deriving from other national or cultural backgrounds.<br><br>- to apply the basic principles of philosophical, ideological and methodological culture in solving the vital and problematic situations in the professional sphere - the ability to abstract, creative thinking and the creative ideas; |
| | | | | 4 | | Philosophy | CCD | | CC | 3 | E | |
| | | | | 5 | | Oil and Gas Law in Kazakhstan | CCD | | | 2 | E | |
| | | | | 1-4 | | Physical Education | CCD | | CC | 8 | HT, E | |

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| | - to demonstrate awareness of the nature of history as an academic discipline and the nature of historical knowledge.<br>- to analyze the challenges of socio-economic, political and spiritual development of human and society from a philosophical position;<br>- to practice implementation of the basic principles of philosophical, ideological and methodological culture;<br>- to analyze various social tendencies: facts and phenomena, to priorities, to plan and set long-term objectives and to operate own life;<br>- to orientate in various stressful situations and to operate with collective on the basis of individual and psychological and gender distinctions ;<br>- to plan and implement actions for increase in health and safety;<br>**Communicative skills – able to**<br>-communicating clearly and coherently, using appropriate historical terminology;<br>-speaking and listening effectively across a range of formal and semi-formal academic and professional communication contexts;<br>-mastering some basic discussion, group work skills and strategies;<br>- to be able to establish professionally important contacts, to master the skills of public speaking and techniques of dialogue and debate in the professional field;<br>- ability to establish professionally important contacts (net-working), acquisition of communication skills and self-regulation, management of collective, leadership skills, oratory and conducting dialogue.<br>**Learning skills and ability – to:**<br>-ability to synthesize publications using critical reading skills;<br>- reading with purpose and with greater effectiveness across a range of academic text genres in English;<br>-writing academically in ways appropriate for success in personal, professional and future academic work;<br>-working effectively with classmates in peer-feedback and collaborative learning activities;<br>- the use of self-study and self-education mechanisms for personal growth and successful career;<br>- capability to enhancement, self-education, to produce the new innovative ideas and technologies in professional activity;<br>- the competitive specialist having creative thinking, | | | | | | | | | | | |

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| | physical health, professionalism, information competences, communicative competences, entrepreneurial and leadership skills to orientate further education. | | | | | | | | | | | |
| Information and Communication | **Knowledge and understanding of:**<br>- understand phrases and the highest frequency vocabulary related to areas of most immediate personal relevance (e.g. very basic personal and family information, shopping, local area, employment).<br>- read very short, simple texts, find specific, predictable information in simple everyday material such as advertisements, prospectuses, menus and timetables and understand short simple personal letters.<br>- communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar topics and handle very short social exchanges, understand enough to keep the conversation.<br>- use a series of phrases and sentences to describe in simple terms my family and other people, living conditions, my educational background and my present or most recent job.<br>-write short, simple notes and messages relating to matters in areas of immediate need<br>-write a very simple personal letter, for example thanking someone for something.<br>- to learn such basic activities as to inform speech act, to declare, to explain, to give instruction, to understand, to encourage joint action The size to learn the lexical 1500 units (Thematic vocabulary acquisition of the Kazakh language. At a basic level. The development as a whole. Astana, 2011)<br>- the rules and regularities of present day languages phonetics and grammar;<br>- and laws and theories of information and communication technology;<br>- common lexicon and profession oriented vocabulary;<br>- methods for solving specific practical tasks in information and communication technology.<br>**Applying the knowledge and understanding –able to**<br>- understand sentences and frequently used expressions related to areas of most immediate relevance and communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters, also describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need. | 19 | 29 | 1,2 | | English | CCD | | CC | 6 | E | - Ability to understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type; to introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has; to interact in a simple way provided the other person talks slowly and clearly and is prepared to help.<br>- Ability to understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment); to communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters; to describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.<br>-Ability to read, listen and make the sounds of the Kazakh language -The ability to persuade the suffixes of the law of synharmonism. Use the suffixes in oral and written speech - The ability to understand what their hear and provide answers in the context of certain lexical topics;<br>- ability for language thinking, analysis and synthesis;<br>- ability for culture of speaking, writing, reading and listening in the studied languages, ability for communication, analysis, information perception, aim setting and choice of ways of its |
| | | | | 1,2 | | Kazakh language | CCD | | CC | 6 | E | |
| | | | | 2 | | Information and communication technology | CCD | | CC | 3 | E | |
| | | | | 3 | | Professional Kazakh Language | BD | | CC | 2 | E | |
| | | | | 4 | | Professionally-oriented foreign language | BD | | CC | 2 | E | |

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| | - learn the type of text, to master the basic kinds of speech activity;<br>- to use the necessary knowledge of the types of speech acts and types of dialogues<br>- using languages and in information and communication technology their inner interrelation and integrity.<br>**Formation of views about:**<br>- connect phrases in a simple way in order to describe experiences and events, dreams, hopes and ambitions;<br>- give reasons and explanations for opinions and plans;<br>- narrate a story or relate the plot of a book or film and describe his/her reactions.<br>- orthographic and orthoepic norms -Suffixes, similar to the law of synharmonism 1,2 Kazakh language CCD A,B,C CC 6 E -Ability to read, listen and make the sounds of the Kazakh language<br>-the ability to persuade the suffixes of the law of synharmonism. Use the suffixes in oral and written speech<br>-the ability to understand what their hear and provide answers in the context of certain lexical topics. 3 Professional Kazakh Language BD CC 2 E<br>- vowels and consonants. Deaf sounds - In the framework of the proposed topics to make oral and written communication<br>- in the use of languages;<br>- in the field of information and communication technology knowledge in professional activity.<br>**Communicative skills – able to**<br>- interact in a simple way provided the other person is prepared to repeat or rephrase things at a slower rate of speech;<br>- ask and answer simple questions in areas of immediate need or on very familiar topics;<br>- communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar topics and activities; handle very short social exchanges.<br>- to develop the student's ability to learn independently - to develop an information culture<br>- Expanding horizons and improving the overall culture<br>-teaching relationships in everyday life and necessary speech samples to solve communicative tasks<br>- to inculcate the ability to apply the basic rules of etiquette<br>-the mastery of the simple syntactic structures to express | | | | | | | | | | | achievement;<br>- Ability to understand, apply and develop knowledge in information and communication technology, knowledge of the subject area (in the context professional activity). |

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| | their needs<br>- to teach to express their opinion according to the information;<br>- to build propositions using the special vocabulary of information and communication technology, to formulate and solve information and communication technology problems in the studied languages.<br>**Learning skills and ability – to:**<br>- ask and answer questions about personal details;<br>- interact in a simple way but communication is totally dependent on repetition, rephrasing and repair;<br>- answer questions and respond to simple statements;<br>- indicate when he/she is following but is rarely able to understand enough to keep conversation going of his/her own accord.<br>- Reports and professional documents:-<br>- select necessary information;<br>- learn how to explain correct schemes and graphics;<br>- translate correct necessary materials from English to Kazakh;<br>- be able to discuss on different points, defend their points of views using correct speech terms;<br>- use correctly main definitions;<br>- write reports and essay using known themes;<br>- understand and select material;<br>- discuss and make recommendations;<br>- enrich speech by using proverbs, idioms.<br>- provide solution of practical and experimental tasks from different fields of information and communication technology, physics,<br>- acquire fundamental skills to solve professional tasks, to select suitable methods and algorithms to solve tasks. | | | | | | | | | | | |
| Physico-mathematical fundamentals of informational technologies | **Knowledge and understanding of:**<br>- the laws and theories of classical and modern mathematics and physics;<br>- techniques and methods of solution;<br>- methods of physical research;<br>- mathematical methods for solving specific practical tasks;<br>- develop knowledge that involves the use of applications in Chemical Engineering and numerical methods using software packages;<br>- develop knowledge that involves solving equations and to introduce both differential calculus and integral calculus; | 11 | 17 | 3 | | Physics | BD | A | CC | 4 | E | - ability for abstract thinking, analysis and synthesis;<br>- ability for culture of thinking, ability for communication, analysis, information perception, aim setting and choice of ways of its achievement;<br>- ability to understand, apply and develop mathematical knowledge, basic laws of natural science, knowledge of the subject area (in the context professional activity) and basic principles of IS. |
| | | | | 1 | | Higher mathematics | BD | A | CC | 4 | E | |
| | | | | 6 | | Statistics for Engineering<br>/<br>Mathematics for Chemical Engineering | BD | | OC | 3 | E | |

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| | **Applying knowledge and understanding –able to**:<br>- the laws, theories of classical and modern mathematics, physics in their inner interrelation and integrity.<br>**Forming propositions**:<br>- in the field of physico-mathematical calculations;<br>- the use of the theory of physico-mathematical knowledge in professional activity.<br>**Communicative skills - able to**:<br>- to build mathematical models using the apparatus of mathematical analysis, to formulate and solve mathematical problems.<br>**Learning skills and ability – to:**<br>- solution of practical and experimental tasks from different fields of physics, as fundamentals of skills to solve professional tasks, to select suitable mathematical methods and algorithms to solve tasks, to make mathematical research;<br>- select and apply mathematical techniques in a variety of mathematical situations;<br>- carry out and interpret one-sample and two-sample analyses for means and proportions;<br>- carry out and interpret statistical modeling using multiple regression and analysis of variance. | | | | | | | | | | | |
| **Specialized modules** | | | | | | | | | | | | |
| Introduction to Specialty | **Knowledge and understanding of:**<br>- structure of modern oil refinery and principles of technological process organization<br>- basic concepts in petroleum chemistry<br>- first and second stages of processing Operations in a Petroleum Refinery<br>- major components and key properties of oil and gas in terms of processing and applications<br>- basic laboratory techniques involved in practical work<br>- different methods used to identify substances and to determine their structure and properties<br>**Applying the knowledge and understanding –able to**<br>- apply theoretical knowledge of chemistry in the context of petroleum chemistry<br>- use basic concepts of oil and gas refining for calculating heat and mass transfer balances<br>- critically analyze information for solving the problems<br>-carry out a variety of experimental procedures<br>-calculate and interpret quantitatively the results of their experiments<br>**Formation of views about**<br>- the principle features of petroleum in terms of | 10 | 15 | 2 | | Introduction to Specialty | BD | A | CC | 2 | E | Be able:<br>-to know theoretical bases of petroleum chemistry<br>-to understand main processes of oil and gas refining and their logical interrelations<br>-to carry out standard laboratory procedures<br>-to calculate and interpret experimental results<br>-to be a part of a team<br>-to write reports and give oral presentations<br>-to understand the various responsibilities engineers have to the society |
| | | | | 1 | | Chemistry | BD | | CC | 2 | E | |
| | | | | 3 | | Petroleum Chemistry | SD | C | OC | 3 | E | |
| | | | | 2 | | Laboratory Skills for Chemists<br>/<br>Modern methods of analysis | CCD | C | OC | 3 | E | |
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| | processing<br>-development perspectives and modernization aspects of oil and gas processing industry<br>- the use of modern analytical methods and their applications in industry<br>**Communicative skills – able to**<br>- to form teamwork skills<br>**Learning skills Learning skills and ability for study**<br>to be able to<br>- use theoretical knowledge and basic practical skills needed for technological process organization and its service | | | | | | | | | | | |
| Chemical sciences | **Knowledge and understanding of:**<br>-the fundamental concepts of organic, analytical, colloid, physical and polymer chemistry<br>-structure of substances, the nature of chemical bonding and reactivity of different classes compounds and their properties,<br>-mechanisms of chemical processes and thermodynamic and kinetic approach<br>- a selection of more specialist topics in the main branches of chemistry<br>-the main techniques involved in practical work<br>-the different methods used to identify molecules and to determine their structure and the basis of the underlying theory<br>**Application of knowledge and understanding – able to**<br>-analyze and solve problems<br>-transfer appropriate knowledge and methods from one topic within subject to another<br>-use knowledge of chemical properties of compounds, materials as a basis for solving of professional tasks<br>-carry out a variety of experimental procedures<br>-calculate and interpret quantitatively the results of their experiments<br>**Formation of views about**<br>-scientific basis of chemistry<br>-interrelation of chemistry branches and their aspects applied in industry<br>- the evolving state of knowledge<br>**Communication skills- able to**<br>-work as part of a team<br>-give oral presentations<br>-plan, conduct and write a report on an independent topic (mini-project) | 16 | 25 | 1 | | Analytic Chemistry | BD | A | OC | 3 | E | Be able:<br>-to know theoretical bases of chemistry<br>-to plan and carry out synthesis of organic compounds<br>-to apply modern methods of substance analysis in practice<br>-to follow practical instructions safely and accurately<br>-to carry out an experiments<br>-to analyse, calculate and interpret results obtained from experiment<br>-to be a part of a team<br>-to apply theoretical knowledge and skills for problem solving<br>-to write reports and give oral presentations |
| | | | | 2 | | Organic Chemistry | BD | A | CK | 4 | E | |
| | | | | 3 | | Physical Chemistry<br>/<br>Technical Thermodynamics | BD | A | OC | 3 | E | |
| | | | | 3 | | Polymer Chemistry<br>/<br>Reaction Activity in Organic Chemistry | BD | A | OC | 3 | E | |
| | | | | 5 | | Colloid Chemistry in Petroleum Engineering<br>/<br>Nanotechnology | BD | A | OC | 3 | E | |
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| | **Learning skills and ability for study**<br>**to be able to**<br>- use methods of synthesis and transformations of chemical systems<br>- analyze qualitatively and quantitatively unknown substance or materials<br>- apply necessary theoretical knowledge and basic practical skills for solving an appropriate chemical problem<br>- use library and IT resources | | | | | | | | | | | |
| Processes and Equipment of Chemical Production | **Knowledge and understanding of:**<br>-Understand the principles and different modes of heat transfer.<br>-Formulate and solve simple problems involving heat conduction in planar, cylindrical and spherical geometries.<br>-Understand the analogy between heat and mass transfer.<br>-Solve steady state and transient heat and mass transfer problems.<br>-Perform basic analysis and design of heat and mass exchangers.<br>-Determine mass transport coefficients from correlations and experimental data.<br>-Understand the process of mass diffusion in gases, liquids, and solids.<br>-Understand the different types of problems encountered in heat and mass transfer and decide on an approach to solving a problem;<br>-Develop the fundamental concepts related with fluid flow<br>**Application of knowledge and understanding –able to:**<br>-Apply these concepts to the design of flow systems<br>- Identify the analytical solutions to simplified flow problems<br>- Apply concepts of mass, momentum and energy to flow systems<br><br>- compare the technical and economic indices of production;<br>- perform the calculations necessary to determine the parameters of the technological regime and performance chemical-technological process,<br>- select and calculate the basic technological machines and apparatus;;<br>- constitute a material and heat balances apparatus and | 13 | 20 | 4 | | Heat and Mass Transfer | BD | A | OC | 3 | E | - to make technically correct and scientifically based calculation using modern calculation means;<br>- assistance in formation of multi-discipline specialist, able to quickly solve difficult practical problems of contemporary production ;<br>- to be able to outline mechanical phenomena, presenting specific mechanical tasks in abstract form, to use mathematical methods when solving engineering tasks;<br>- to be able to calculate the main vessels and connection joints of technological installations, to make optimal technological, economical and ecological decisions using calculation machines;<br>- to use existing calculation methods and information transfer methods about themorodynamical qualities of substances, used in heat engineering installations;<br>- to apply received knowledge to calculate general characteristics of thermodynamical processes |
| | | | | 4 | | Fluid Mechanics<br>/<br>Separation Process Fundementals | BD | A | OC | 4 | E | |
| | | | | 5 | | Oil and Gas Processing Machines and Devices | BD | C | OC | 3 | E, CP | |
| | | | | 5 | | Electrotechnics | BD | C | OC | 3 | E | |

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| | chemical-technological systems;<br>- know the basic types of equipment, how they work and the sequence of technological equipment of chemical plants, the selection criteria for chemical devices and accessories based on occurring processes.<br>**Formation of views about**<br>- in formulating and solving problems of industrial analysis related to the choice of optimal mode of production, the selection of modern equipment;<br>- knowledge and understanding of the general laws of chemical processes of various chemical industries;<br>- application of knowledge and understanding in the analysis of the structural and technological schemes of production, the main material flows and technological links in them;<br>**Communication skills- able to**<br>-work as part of a team<br>-give oral presentations<br>-plan, conduct and write a report on an independent topic (mini-project).<br>**Learning skills and ability – to:**<br>-undertake own study, learn to set goals, find and use the necessary means and ways of achieving them, monitor and evaluate the process and results of operations;<br>- ensure the successful assimilation of knowledge, the formation of skills and competencies in related subject area. | | | | | | | | | | | |
| Oil and gas Refining | **Knowledge and understanding of:**<br>- history and main directions of processing of hydrocarbon raw materials;<br>- guidelines and scientific bases of preparation of oil, gas and coal for processing;<br>- separation techniques and primary processing of petroleum hydrocarbon raw materials:<br>- secondary processes of hydrocarbon processing;-Modern technological processes, providing valuable organic compounds on the basis of primary and secondary processing of oil products, gas and solid fuels | 18 | 28 | 4 | | Fundamentals of Oil and gas processing | BD | A | CC | 3 | E | - to apply received knowledge in solving technical, technological, economical an management tasks and preparing students to the perception of special courses studying materials;<br>- to know physical-chemical qualities of perspective processes of organic and petrochemical production, its technological peculiarities, theoretical |
| | | | | 5,6 | | Technology of Processing Hydrocarbon raw materials | SD | A | CC | 5 | E, CP | |
| | | | | 6 | | Polymers and Composite Materials Production | SD | C | OC | 3 | E | |
| | | | | 6 | | Oil and Gas refining | SD | C | OC | 4 | E | |

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| | - the basics of polymers and plastics technology based on them;<br>- principles for the organization of technological processes of processing of hydrocarbon raw materials<br>**Application of knowledge and understanding –able to:**<br>- for the description and analysis of the existing technological processes of processing of hydrocarbon raw materials, production of plastics;<br>- to develop new highly efficient and economical manufacturing processes of organic and inorganic substances from the hydrocarbon;<br>- for the selection of the most efficient main and auxiliary equipment in the development of technological schemes;<br>- for solving the problems on industrial hydrocarbon processing methods for producing organic substances and polymers.веществ and polymers.<br>**Formation of views about**<br>- on issues relating to technologies for processing of hydrocarbon raw materials, industrial processes for the production of the most important organic materials and polymers;<br>- on the basis of knowledge and understanding to form independent judgments on specific issues of the oil refining industry.<br>**Communication skills- able to**<br>- be able to choose and count processes hydrocarbon processing;<br>- to determine the influence of various factors and parameters on the course of the process;- Be able to plan and carry out the synthesis of organic compounds, efficiently organize the process.<br>**Learning skills and ability – to:**<br>-have the skills description of chemical-technological processes of processing of hydrocarbon raw materials;<br>- to develop and calculate different variants of the | | | 5 | | Thermo Chemical Processing Technologies | SD | C | OC | 3 | E | fundamentals of vessel layout;<br>- to make optimal decisions in combining installation on factories, matching of modern domestic and foreign processing indicators, in problems of ecology in organic substances technology . |

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| | process;<br>- have the skills of the synthetic products of petrochemical production in the laboratory, to conduct calculations yield of the reaction products and to make an analysis of the results.Modern technological processes, providing valuable organic compounds on the basis of primary and secondary processing of oil products, gas and solid fuels<br>- the basics of polymers and plastics technology based on them;<br>- principles for the organization of technological processes of processing of hydrocarbon raw materials. | | | 7 | | Thermo Chemical Processing Technologies | | | | 3 | E | |
| Fundamentals of Process Control | **Knowledge and understanding of:**<br>- the basic concepts of the basic measurements for technological parameters;<br>- schematic of devices and circuits izmeretelnyh;<br>- the basic concepts in systems of automatic control;<br>-explain and apply the workflow of developing models and conducting numerical simulations<br>**Application of knowledge and understanding –able to:**<br>- to choose the most appropriate method of analysis of the object with the light of the objectives, time and economic costs;<br>- to identify the main environmentally hazardous production factors;<br>- to select the most efficient main and auxiliary equipment in the development of technological scheme.<br>- apply standard tools to solve practical engineering problems<br>**Formation of views about**<br>- knowledge and understanding of the methods of physical and chemical analysis;<br>- application of knowledge and understanding of the learning process and further professional activities;<br>- forming judgments about the preparation, holding and processing of analysis results;<br>- in the formulation and solution of problems of industrial analysis related to the creation of "clean" technologies using modeling objects and processes of chemical technology.<br>**Communication skills - able to**<br>-the ability to choose for this process automation function scheme;<br>- ability to develop plans, programs, procedures related to the automation of technological processes and | 6 | 10 | 7 | | Process Simulation | SD | C | OC | 3 | E | -with knowledge, skills in the field of applying controlling-metrical instruments and means of automation; modern methods of control and regulating technological processes;<br>- To be able to use modern automatic vessels for profound analysis of hydrocarbon structure and oil's physical-chemical qualities; with modern research methods areas of use; |
| | | | | 7 | | Instrument and control System | BD | C | OC | 3 | E | |

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| | production.<br>**Learning skills and ability for study to be able to**<br>- learn, be a selective learner and enhance self-learning;<br>-providing the successful assimilation of knowledge, the formation of skills and competencies in any related subject area. | | | | | | | | | | | |
| Production safety and Management | **Knowledge and understanding of:**<br>- have a clear idea of the main questions of labor protection and safe engineering in various aspects of the chemical industry, the priority principles of forming of safe and harmless working conditions when carrying out chemical engineering procedures.<br>-have a clear idea of the principles of forming of ecological safe technologies of neutralization of waste (gaseous, liquid and firm).<br>**Application of knowledge and understanding –able to:**<br>be able to choose modern means of collective and individual protection working, safe methods of work in various areas of productive activity, to determine and classify sources of dangerous and harmful production factors, make engineering decisions on improvement of working conditions, this is to minimize and eliminate injuries and occupational diseases.<br>**Formation of views about**<br>**-**the main questions of labor protection and safe engineering in various disciplines of the chemical industry.<br>**Communication skills- able to**<br>- work in group, use of information and communication technologies in professional activity;<br>- write professional report and deliver presentations<br>- understand technical language and make relevant queries about unclear cases.<br>**Learning skills and ability –to:**<br>– determine and classify sources of danger and harm in the working area and production rooms, to check weather conditions in the producing environment, noise level, illumination on workplaces, level of fire and potential explosion of engineering procedures, quality of ventilating installation works. | 14 | 22 | 5,6 | | Energy Management | SD | C | OC | 5 | E | - to develop and prove the variants of effective management solutions and choose the most optimal of them; to select and apply leadership style, that will provide result and efficiency of an organization; to evaluate final results of the management object;<br>- to possess with high responsibility, discipline and working efficiency;<br>- to be able to apply basic and professional knowledge and skills in planning economic and industrial work of an enterprise in this field. |
| | | | | 7 | | Production safety<br>/<br>Ecological management | BD | C | OK | 3 | E | |
| | | | | 7 | | Environmental Management<br>/<br>Environmental Sustainable Development | BD | C | OK | 3 | E | |
| | | | | 7 | | Economics of Enterprises | SD | C | OK | 3 | E | |
| Project | **Knowledge and understanding of:**<br>- Demonstrate a critical understanding of a chosen topic relevant to the field of chemical engineering; | 14 | 22 | 2 | | Project 1 | CCD | A | OK | 2 | P | -synthesize information from a wide variety of sources and critically evaluate and select relevant |

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| | - Identify relevant literature and suitable sources for information on a chosen topic;<br>- Construct a critical literature review;<br>- Construct a sound research query by means of research questions and/ or research hypothesis;<br>- Design and justify a suitable research framework within which to undertake an inquiry into a chosen topic;<br>- Identify suitable research approach and methods;<br>- Engage effectively in the process of autonomous learning and project management;<br>**Application of knowledge and understanding –able to:**<br>-Construct material and energy balances for a reactor;<br>-Design a non-isothermal reaction system engineering for a single reactor or multiple reactions;<br>-Design a suitable heat exchangers for endo- or exo-thermic reactions to supply or remove heat generated by reactions<br>-Write results of experiments using technical language.<br>**Formation of views about**<br>-Acquire initial research skills; Identify gaps in the literature; understand and explain what a research problem is; identify suitable methodological approach;<br>-Write a research proposal;<br>-realize the complexity and seriousness of real-life chemical engineering related problems.<br>-Describe chemical reactors using models.<br>**Communication skills- able to**<br>-Present information in an appropriate style, adhering to standard academic and/or professional conventions, giving full details of sources used according to the referencing standard laid down.<br>-Establish and enhance skills of time management and communication of conducted research.<br>**Learning skills and ability – to:**<br>Apply basic numerical tools to design problems, make decision(s) on which model is suitable for a reactor that provide the accuracy | | | 4 | | Project 2 | BD | C | OK | 3 | E | information<br>-Identify a suitable approach/methodology and appropriate professional techniques<br>-Solve open-ended design problems<br>-Write technical report<br>-Establish and enhance time management, communication and team working skills<br>-demonstrate intellectual ability to work professionally and study independently |
| | | | | 6 | | Project 3 | SD | C | OK | 3 | E | |
| | | | | 3 | | Fundamentals of Engineering Design | BD | C | OK | 3 | E, P | |
| | | | | 7 | | Plant Design | SD | C | OK | 3 | E | |
| Internship | **Knowledge and understanding:**<br>- familiarize students with laboratory equipment, their purpose and use, the main stages of the chemical analysis, the method of the experiment;<br>- Familiarity with the chemical enterprises and organizations of the city by means of organizing the | 5 | 15 | 2 | Prak | Educational Practice | | | | 4 | credit | - study of regulatory and technical documents that defines requirements for the design and organization of the process in terms of crash protection;<br>- collecting and preparing material |

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| | excursions to the leading enterprises of the city; consolidation, expansion and deepening of theoretical knowledge;<br>-practical implementation of chemical and instrumental analyzes in laboratories.<br>**Applying knowledge and understanding**:<br>consolidation of theoretical knowledge on special subjects; research and development process, and the expansion of knowledge on the production activities of the main structural unit of the enterprise (workshop, installation); study of regulatory and technical documents that defines requirements for the design and organization of the process in terms of crash protection.<br>**Forming propositions**:<br>- on technologies of organic substances production<br>**Communication skills**:<br>-Demonstrating an independent approaches to solving problems, describing assessments methods and constructing conclusions;<br>- describing and justifying the selection of reliable data, results of the analysis and their own recommendations,<br>- constructing an appropriate report that contains a solution to a particular problem;<br>**Learning skills and ability – to:**<br>-consolidate and deepen theoretical knowledge on special subjects;<br>-acquire practical skills and competencies, as well as the development of best practices;<br>-utilization of research and development, and the expansion of knowledge about the production activities of the main structural unit of the enterprise (workshop, installation). | | | 4 | Prak | Industrial Practice | | | | 2 | credit | for the implementation of the diploma project (work). |
| | | | | 6 | Prak | Industrial Practice | | | | 2 | credit | |
| | | 11 | 18 | 8 | Prak | Pre-Diploma Practice | AHE | A | CC | 4 | credit | |

## 3. Summary table on the content of the educational program

| Study course | Term | Amount of modules | Amount of subjects | | | Amount of credits KZ | | | | | | Total in hours | ECTS | Amount | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CC | OC | Theoretical education | Teaching practice | Internship | Pregraduation practice | Physical education | Final examination | Total | | | exam | credit |
| 1 | 1 | 6 | 5 | 1 | 18 | | | | 2 | | 20 | 840 | 30 | 6 | 1 |
| | 2 | 5 | 6 | 1 | 20 | 4 | | | 2 | | 26 | 945 | 30 | 8 | |
| 2 | 3 | 6 | 4 | 2 | 18 | | | | 2 | | 20 | 840 | 30 | 6 | 1 |
| | 4 | 7 | 5 | 3 | 18 | | 2 | | 2 | | 22 | 1080 | 30 | 9 | |
| 3 | 5 | 6 | 1 | 5 | 19 | | | | | | 19 | 810 | 30 | 4 | 2 |
| | 6 | 5 | 1 | 5 | 18 | | 2 | | | | 20 | 960 | 30 | 5 | 1 |
| 4 | 7 | 4 | | 6 | 18 | | | | | | 18 | 810 | 30 | 5 | 1 |
| | 8 | | | | | | | 4 | | 3 | 7 | 615 | 30 | | |
| Total | | 39 | 22 | 23 | 129 | 4 | 4 | 4 | | 3 | 152 | 6900 | 240 | 43 | 6 |

## 4 Learning outcomes of the educational program

Graduates of this course should acquire the following abilities:

- To demonstrate suitable understanding in the conversion of crude oil into fuels and chemical feedstock.
- To Organize and implement control input feedstock, materials and auxiliary materials for existing production lines and processes.
- To appraise the principal corrosion mechanisms relevant to chemical engineering equipment and processes.
- To understand and apply fundamental concepts of materials science; key physical, chemical and mechanical properties of the commonly used engineering materials; and principal knowledge of material processing.
- To produce Process Flow Diagrams (PFDs) and Piping and Instrumentation Diagrams (P&IDs).
- To undertaking technological control of a number of processes and aspects related to chemical engineering profession. These include: production lines, processes and technological equipment that are necessary for the production and processing of organic materials, processing of oil, gas and coal, polymers, elastomers, synthetic fibers according to the requirements of industrial production schedules and technical and operational documentation.

- To apply engineering design procedures, fundamental facts, concepts, theories and principles for operation unit designs.
- To designing new, and to modernize existing, technological schemes, the choice of process parameters; calculation of equipment selection.
- To design refining processes by applying thermodynamic property correlations to meet required specifications; and to evaluate and select process conditions to obtain desired products.
- To carry out extensive engineering calculation by following design handbooks for the sizing of different devices.
- To identify the requirement of designing devices for a processing line to meet processing capacity and product specification.
- To prepare and maintain design and estimate documentation, ensuring the effectiveness of the design solutions.

- To demonstrate detailed knowledge of process control techniques applied to industrial processes; and to appreciate relevant computer tools for modelling and analysis.
- To adapt an innovative approach to problem solving and to identify and assess constraints; and to analyze complex situations of a multi-disciplinary nature to create practical solution strategies.

- To apply state-of-the-art computer tools and interpret results; and to apply numerical methods to analyze different dynamic systems and conduct numerical simulations.
- To use suitable methods and tools for analysis to practice expertise and diagnostic of the condition and dynamics of activity object: technological processes, equipment, etc.
- To use mathematical models to analyze and evaluate alternative technological options and units.

- To critically evaluate various environmental challenges and issues from global perspective; identify sustainable development indicators to preserve the environment; demonstrate awareness of environmental, legal, regulatory and safety issues relevant to the 'Chemical Engineering' profession.

- To prepare professional engineering report and to professionally communicate effectively in and outside the workplace.
- To work cooperatively and effectively and to appreciate the benefits of teamwork and leadership.
- To demonstrate further personal development for a career, and career enhancement, as an engineer.