



KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY  
INSTITUTE OF NATURAL SCIENCES  
8D05301-CHEMISTRY  
Catalog of elective disciplines

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## 1. OPTIONAL COMPONENT OF THE CYCLE OF CORE COURSES

### *Optional component 1*

**Course: Commercialization of research and development**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SPM-2**

*Module Name:* Scientific and professional module

*Prerequisites:* no

*Purpose:* the study of the methodological foundations of scientific knowledge, the structure and main stages of scientific research. The training course forms methods, models of scientific research and is aimed at choosing the right direction of scientific research.

*Short Description:* Principles and forms of organization of scientific and technical activities, its results, content of concepts of technology and transfer of technologies. The content of basic methods of assessing the commercial potential of pedagogical technologies, its usefulness and potential cost. Stages of commercialization of research results, model of commercialization of scientific and educational research results. Protecting intellectual property objects and the rights to use them in the process of commercializing the results of scientific and educational research. The theoretical and methodological aspects of the business plan to commercialize research and pedagogical research. Transfer of technology. Interactions with government agencies, companies, scientific organizations.

*Learning Outcomes in EP (LOP):*

LO4 – Develops new technologies for the production of chemicals with the determination of their purity, structure, properties, using existing technologies.

LO5 – Processes experimental data using linear and nonlinear analysis methods, including the use of specialized Internet resources.

*Learning Outcomes in Course (LOC)*

LOC 1 - has a methodology for assessing the commercial potential of the results of scientific research and pedagogical developments and the protection of intellectual property.

LOC 2 - independently uses the necessary methods, means, and ways to obtain a commercial result from the practical use of scientific developments.

LOC 3 - Is able to carry out a critical analysis and evaluation of modern scientific and pedagogical achievements, transform new ideas in solving research and practical problems, including interdisciplinary ones.

LOC 4 - Is able to implement entrepreneurial initiatives in project management in scientific, educational organizations, social institutions.

LOC 5 - is able to plan and solve the tasks of his professional and personal development.

*Post requisites:* no

### *Optional component 1*

**Course: Modern inorganic materials and technologies**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SPM-2**

*Module Name:* Scientific and professional module

*Prerequisites:* no

*Purpose:* study of the theoretical foundations of the chemistry of promising inorganic substances and materials, methods for their preparation and application.

*Short Description:* To systematize the basic scientific and technical information about the objects and technologies for the production of inorganic substances and materials; Critically assess the latest achievements in the theory and practice of chemical technology; Develops schemes of modern technological processes for the production, processing of inorganic materials and products from them; Solve scientific and technical problems of chemical technology of inorganic substances in priority areas of industry in Kazakhstan in new and unfamiliar conditions using modern methods of research, analysis, diagnostics and modeling; Carries out the analysis, planning and organization of the educational process in chemical and chemical-technological disciplines in higher education organizations using modern educational technologies and teaching methods; Improve methods of control of inorganic technology processes and methods of analysis of raw materials and finished products; Work with modern scientific and technical literature, databases and software in the field of chemical technology.

*Learning Outcomes in EP (LOP):*

LOP3 – Conducts scientific research using modern research methods, educational and information technologies based on theoretical analysis and empirical research, systematizing the logic and methods of scientific research.



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LOP4 – Develops new technologies for the production of chemicals with the determination of their purity, structure, properties, using existing technologies.

LOP5 – Processes experimental data using linear and nonlinear analysis methods, including the use of specialized Internet resources.

*Learning Outcomes in Course (LOC):*

LOC 1- to have an idea of the principles of the scientific worldview, about the current state of science;

LOC 2- availability of research methods and skills for conducting experimental work;

LOC 3- is able to independently formulate specific research tasks and carry out their in-depth development;

LOC 4- knows the current state of science, the main directions of scientific research, priority tasks;

LOC 5- knows the current state of science, the main directions of scientific research;

LOC 6- knows the methods of research and experimental work, the rules of operation of research equipment, methods of analysis and processing of experimental data;

LOC 7 - uses the acquired theoretical knowledge, skills and abilities developed in research activities;

*Post requisites:* DSRW Doctoral student research work, including internship and doctoral dissertation

## 2. OPTIONAL COMPONENT OF THE CYCLE OF MAJOR COURSES

### *Optional component 1*

**Course: Processing and technology of hydrocarbon raw materials**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SPM-2**

*Module Name:* Scientific and professional module

*Prerequisites:* MMSOEMIOC Modern mass spectrometric, optical and electrochemical methods for the identification of organic compounds

*Purpose:* the main goal of the discipline is determined by the principles: scientific nature, connections between theory and practice, accessibility, take into account the professionally significant qualities of a specialist in this profile and are based on the study of the classification of chemical methods for the processing and purification of oil and gas raw materials, technological processes for obtaining liquid components of fuels, lubricants, solid hydrocarbons based on thermodestructive, catalytic, hydrogenation processes, as well as to study the latest achievements and newest technologies in the field of production of products of chemical processing of oil and gas.

*Short Description:* Main directions of oil and gas processing. Classification of oil and petroleum products. Basic methods of oil and gas production. Preparation of gases for processing: desulfurization and drying of gases. Classification of primary processes of processing of hydrocarbon raw materials. The main types of devices the primary distillation of crude oil. Types of electric dehydrators and their purpose. Rectification columns and types of plates used. Furnaces of primary oil distillation units and their types. Thermal processes, classification and their main purpose. Preparation of material and heat balances of the coking plant. The calculation of the reactor of the Hydrotreatingunit. Development of a flow diagram of oil refining for fuel and complex options.

*Learning Outcomes in EP (LOP):*

LOP1 – Is Capable of critical analysis and evaluation of modern scientific achievements, generating new ideas when solving research and practical problems, including in interdisciplinary areas.

LOP4 – Develops new technologies for the production of chemicals with the determination of their purity, structure, properties, using existing technologies.

LOP6 – Solves the problems of production analysis related to the creation and processing of materials using modeling of objects and processes of chemical technology.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the general scientific foundations and patterns of oil, gas and gas condensate processing;

LOC 2 - knows the scientific basis of the processes of processing oil and gas raw materials by physical and chemical methods;

LOC 3 - knows the technological foundations and schemes of oil and gas refining processes;

LOC 4 - know how to use the quantitative laws of chemical reactions for the optimal industrial implementation of chemical processes of petrochemical synthesis.

LOC 5 - owns the methods of kinetic analysis and processing of the results of kinetic experiments;

LOC 6 - possesses deep, specialized knowledge, on the basis of which critical analysis, assessment and synthesis of innovative ideas are carried out.

LOC 7 - is able to use the basic knowledge of natural sciences in professional activities, apply theoretical and experimental research

*Post requisites:* DSRW Doctoral student research work, including internship and doctoral dissertation



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*Optional component 1*

**Course: Morphology of the structure and properties of carbon-containing nanomaterials**

*Intensity of the Course:* 5 academic credits

*Module Code:* **SPM-2**

*Module Name:* Scientific and professional module

*Prerequisites:* MSR Methods of scientific research

*Purpose:* The purpose of the discipline is to familiarize with the features of the properties of materials in the nanostructured state, methods of their preparation and research, to form ideas about modern achievements in the field of nanotechnology and the prospects for their practical use.

*Short Description:* Carbon nanotubes and nanofibers. Structure of fullerene-like nanostructures. Carbon nanotubes. Properties of carbon nanomaterials (CNM). Methods for obtaining CNM. Synthesis of CNM from carbon-containing gases. Mechanism of growth of carbon nanostructures. Apparatus for production of carbon nanomaterials. Technology of production of catalysts for the synthesis of carbon nano-material. Capacitive reactor for synthesis of CNM with a fixed bed of the catalyst.

*Learning Outcomes in EP (LOP):*

LOP 4 – Develops new technologies for the production of chemicals with the determination of their purity, structure, properties, using existing technologies.

LOP 6 – Solves the problems of production analysis related to the creation and processing of materials using modeling of objects and processes of chemical technology.

*Learning Outcomes in Course (LOC):*

LOC 1 - knows the general scientific foundations and patterns of oil, gas and gas condensate processing;

LOC 2 - knows the scientific basis of the processes of processing oil and gas raw materials by physical and chemical methods;

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LOC 7 - is able to use the basic knowledge of natural sciences in professional activities, apply theoretical and experimental research

*Post requisites:* DSRW Doctoral student research work, including internship and doctoral dissertation