

First level (Bachelor's degree)

Code and name of Ukrainian specialty – 0711 Chemical engineering and processes

EDUCATIONAL PROGRAM – Industrial ecology and resource efficient cleaner technologies

Department of Ecology and Plant Polymers Technology

Language of study – English

Educational offers		
Year of study/ semester	COURSE TITLE	Number of ECTS credits / semester control
2 / fall semester	Analytical Chemistry - I. Qualitative Analysis	5,0/exam
	Chemistry of plant polymers	4,0/ test
2 / spring semester	Analytical Chemistry - II. Quantitative Analysis	5,0/exam
3 / fall semester		
3 / spring semester	Environmental Protection Organization and Management	4,0/ exam
	Toxicology	5,0/exam

DESCRIPTIONS OF COURSES

Chemistry of plant polymers	
Restrictions (specialty for which the course is offered)	<i>Chemical engineering and processes</i>
Educational level	<i>First level (Bachelor's degree)</i>
Year of study	<i>2</i>
Number of ECTS credits	<i>4</i>
Language of study	<i>English</i>
Department	<i>Ecology and Plant Polymers Technology</i>
Assumed knowledge and prerequisites	<i>English B2, basic knowledge of general and inorganic chemistry, organic and analytical chemistry, biology and ecology</i>
Scope of the course	<i>The scope of the course includes the study of the chemical composition of coniferous and deciduous wood, non-wood plant materials; properties of the main components of plant raw materials - cellulose, lignin, hemicellulose, resins, fats and waxes, as well as minerals; classification and methods of obtaining macromolecular compounds; structure, chemical composition and properties of lignin; chemistry of processes of delignification of plant raw materials.</i>
Rationale	<i>The educational component contributes to the development of professional expertise in basic knowledge necessary for professional management of technological processes of chemical processing of plant raw materials. This knowledge is needed to develop new and modernize existing technologies for the rational use of plant polymers in the production of cellulose-containing consumer goods.</i>
Learning outcomes	<i>Expected learning outcomes include:</i> <ul style="list-style-type: none"> - <i>knowledge of the basic principles of chemistry of plant polymers to understand their structure and patterns of their chemical transformations in modern thermochemical processes;</i> - <i>knowledge of classification and properties of plant polymers, pulp products, cellulose and products of their processing;</i> - <i>ability to conduct a comparative analysis of the main components of different representatives of plant raw materials to select rational environmentally friendly methods of processing plant materials into cellulose-containing products.</i>
Competencies and skills	<i>Upon successful completion of the course students are expected to be able to:</i> <ul style="list-style-type: none"> - <i>use the basic principles of chemistry of plant polymers to predict the quality of cellulose, paper and cardboard, intermediate and final products of chemical technology for processing plant materials;</i> - <i>use knowledge of the conformation and supramolecular structure of cellulose and hemicellulose to choose ways to process them into cellulose-containing products for general use;</i> - <i>determine the directions of processing of the main components of plant raw materials to obtain pulp, cellulose, its derivatives and other cellulose-containing products;</i> - <i>substantiate the mechanism of chemical transformations of main components of plant raw materials in the processes of delignification and other thermochemical processes.</i>
Instructional Materials	<i>syllabus, learning materials (textbook, reference book, video lectures, podcasts etc.)</i>
Mode of delivery	<i>lectures, workshops, laboratory work</i>
End-of-semester control	<i>Test</i>

DESCRIPTIONS OF COURSES

Environmental Protection Organisation and Management	
Restrictions (specialty for which the course is offered)	<i>Chemical engineering and processes</i>
Educational level	<i>Bachelor's degree</i>
Year of study	<i>3</i>
Number of ECTS credits	<i>6</i>
Language of study	<i>English</i>
Department	<i>Ecology and Plant Polymers Technology</i>
Assumed knowledge and prerequisites	<i>English</i>
Scope of the course	<i>The scope of the course includes theoretical foundations of management, the main directions of ecological policy of the state, international experience in environmental management.</i>
Rationale	<i>At the present stage, socio-economic development leads to increased anthropogenic impact on the environment, which reduces its ability to self-healing. In addition, there are clear signs of ecological crisis, which are manifested in the degradation of the environment. Therefore, it is important to find the optimal interaction between the environment and meet the basic needs of society. Taking into account the social, economic and environmental interests of society is ensured through the environmental policy of the state, which is implemented through the system of environmental management. The Department ensures the implementation of legislation, control over compliance with environmental safety requirements, carrying out comprehensive measures aimed at the rational use of natural resources, achieving coordination of actions of state and public bodies in the field of environmental protection.</i>
Learning outcomes	<i>Expected learning outcomes include:</i> <ul style="list-style-type: none"> <i>– knowledge of tools and mechanisms for environmental management at the local, regional, national and international levels, taking into account the program of sustainable development at all levels;</i> <i>– be able to assess the impact of basic environmental laws on management decisions;</i> <i>– to adapt international management experience in the practice of environmental activities of rational use of natural resources;</i> <i>– to define ecological problems of Ukraine and to solve them in the context of strategy of ecological policy of the state</i>
Competencies and skills	<i>Upon successful completion of the course students are expected to be able to:</i> <ul style="list-style-type: none"> <i>– Use the basic principles and composition of environmental management;</i> <i>– inform the public about the state of environmental safety and sustainable use of nature;</i> <i>– formulate requirements for personnel management and use in practice the principles of personnel selection management;</i> <i>– interact with participation in the management of environmental actions and / or environmental projects.</i>
Instructional Materials	<i>syllabus, learning materials (lecture notes, presentations, reference book)</i>
Mode of delivery	<i>lectures (seminars/workshops /tutorials)</i>
End-of-semester control	<i>Exam</i>

DESCRIPTIONS OF COURSES

Toxicology	
Restrictions (specialty for which the course is offered)	<i>Chemical engineering and processes</i>
Educational level	<i>First level (Bachelor's degree)</i>
Year of study	3
Number of ECTS credits	5
Language of study	English
Department	<i>Ecology and Plant Polymers Technology</i>
Assumed knowledge and prerequisites	<i>Toxicology course studying based on knowledge of biology, general ecology, inorganic, organic and analytical chemistry</i>
Scope of the course	<i>The main directions of toxicology, peculiarities of the various environment pollutants influence on living organisms and ecosystems as a whole</i>
Rationale	<i>Understanding the basics of toxicology becomes especially important for the period of intensification of anthropogenic pollution, because it allows you to manage environmental risks, avoid dangerous situations and poisonings. Toxicology provides critically important information and knowledge that can be used to make the balanced decisions about personal safety, homeostasis of natural ecosystems and to promote the concept of sustainable development in a global scale</i>
Learning outcomes	<i>To find out the impact of certain groups of pollutants on living organisms, to master the methods of toxicological calculations and to learn to assess the degree of toxicological risk.</i>
Competencies and skills	<i>After mastering the "Toxicology" discipline students will acquire competencies:</i> <ul style="list-style-type: none"> – <i>tracking the movement of xenobiotics in ecosystems along trophic chains;</i> – <i>assessment the toxicity degree of various substances and media;</i> – <i>determination of the class of toxicity and danger of chemical pollutants according to the parameters of toxicometry.</i>
Instructional Materials	<i>A course of lectures that can be taught remotely</i>
Mode of delivery	<i>Lectures, practical and laboratory classes</i>
End-of-semester control	<i>Exam</i>

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DESCRIPTIONS OF COURSES

Analytical Chemistry - I. Qualitative Analysis	
Restrictions (specialty for which the course is offered)	<i>Chemical engineering and processes</i>
Educational level	<i>First level (Bachelor's degree)</i>
Year of study	<i>2</i>
Number of ECTS credits	<i>5</i>
Language of study	<i>English</i>
Department	<i>Ecology and Plant Polymers Technology</i>
Assumed knowledge and prerequisites	<i>English B2, Completion of educational component "Inorganic Chemistry", "Physics", "Mathematics"</i>
Scope of the course	<p><i>The scope of the course includes</i></p> <ul style="list-style-type: none"> <i>– basic laws of chemistry used in analytical chemistry;</i> <i>– logical connection between methods of analytical chemistry and chemical properties of molecules and ions;</i> <i>– general provisions of the basics of chemical methods of analysis;</i> <i>–extensive laboratory practice in qualitative chemical analysis of kations and anions.</i>
Rationale	<i>The educational component contributes to the development of professional expertise in principles and methods of chemical analysis, promoting the achievement of a more in-depth understanding of chemical processes and the laws of their course.</i>
Learning outcomes	<p><i>Expected learning outcomes include:</i></p> <ul style="list-style-type: none"> <i>– study of theoretical bases of chemical methods of analysis in the control of human objects and the environment;</i> <i>– scientific substantiation of general approaches in the selection and development of methods for determining the chemical composition of substances, their concentration, separation and identification.</i>
Competencies and skills	<p><i>Upon successful completion of the course students are expected to be able to:</i></p> <ul style="list-style-type: none"> <i>– prepare necessary materials and reagents for analysis;</i> <i>– perform qualitative analysis of simple objects of man-made and natural origin;</i> <i>– perform calculations of analysis results.</i>
Instructional Materials	<i>syllabus, learning materials (textbook, reference book)</i>
Mode of delivery	<i>lectures, laboratory practices</i>
End-of-semester control	<i>Exam</i>

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DESCRIPTIONS OF COURSES

Analytical Chemistry - II. Quantitative Analysis	
Restrictions (specialty for which the course is offered)	<i>Chemical engineering and processes</i>
Educational level	<i>First level (Bachelor's degree)</i>
Year of study	<i>2</i>
Number of ECTS credits	<i>5</i>
Language of study	<i>English</i>
Department	<i>Ecology and Plant Polymers Technology</i>
Assumed knowledge and prerequisites	<i>English B2, Completion of educational component "Inorganic Chemistry", "Physics", "Mathematics"</i>
Scope of the course	<p><i>The scope of the course includes</i></p> <ul style="list-style-type: none"> <i>– the theoretical foundations and practical skill in quantitative (gravimetric, titrimetric) chemical analysis;</i> <i>– acquaintance with the rules of work with chemical utensils and analytical scales;</i> <i>– study of preparation methods of compounds for analysis;</i> <i>– the basic principles of analytical research;</i> <i>– study of methods of analytical evaluation of analysis results.</i>
Rationale	<i>The educational component contributes to the development of professional expertise in the theoretical foundations of quantitative chemical analysis and mastering the practical skills of its implementation. The students will learn the theoretical basis of modern analytical chemistry, the main stages of analytical research, the features of different methods for determining chemical ingredients in the environment.</i>
Learning outcomes	<p><i>Expected learning outcomes include:</i></p> <ul style="list-style-type: none"> <i>– to run qualitative control in solving of environmental problems;</i> <i>– to perform quantitative analysis of simple objects of man-made and natural origin;</i> <i>– the ability to work with laboratory equipment.</i>
Competencies and skills	<p><i>Upon successful completion of the course students are expected to be able to:</i></p> <ul style="list-style-type: none"> <i>– to perform quantitative analysis of simple objects of man-made and natural origin;</i> <i>– to perform calculations of the composition of the system, the amount of substance of the reacting compounds for the development of technological processes</i> <i>– the ability to work with laboratory equipment</i> <i>– using the theoretical provisions of analytical chemistry and reference data, calculate the necessary parameters (masses of substances, volumes of solutions, concentrations of components) for preparation of working solutions (titrants, buffers, indicators) for the purpose of their standardization;</i> <i>– to evaluate the possibilities of analysis methods and reasonably choose a method for a specific practical analysis;</i>
Instructional Materials	<i>syllabus, learning materials (textbook, reference book)</i>
Mode of delivery	<i>lectures, laboratory practices</i>
End-of-semester control	<i>Exam</i>