Partner 6
LVIV POLYTECHNIC NATIONAL UNIVERSITY (Ukraine)

Brief description of Partner University: *Lviv Polytechnic National University is the oldest technical higher educational institution in Ukraine and one of the oldest universities in the world; its origins date back to 1816. Lviv Polytechnic is one of the TOP 5 the best higher educational and scientific universities of Ukraine and is famous all over the world.*

Today, Lviv Polytechnic is a powerful centre of science and education in Europe with over 35 000 students studying, including international students from 30 countries. There are 64 Bachelor, 57 Master and 55 PhD programs. A scientific and pedagogical personnel consists of more than 2500 people. Among them there are 350 doctors of science, professors and over 1200 PhD, Associate Professors who work in different fields of science.

Our university is divided into 18 institutes due to the educational and scientific directions.

Our Institute Vyacheslav Chornovil Institute of Sustainable Development belongs to the Chemical, ecological and natural directions.

It is one of the youngest educational and scientific institutes of Lviv Polytechnic University. It was established in October 2011 on the basis of the V. Chornovil educational and research Institute of Advanced Technologies and Management and the Department of Ecology and Environmental Protection from the educational and research Institute of Chemistry and Chemical Technologies.

There are 5 departments in the structure of the Institute: 1. Department of Ecology and Sustainable Environmental Management. 2. Department of Environmental Safety and Nature Protection Activity. 3. Department of Ecological Politics and Environment Protection Management. 4. Department of Tourism. 5. Department of Civil Safety. The department staff includes 4 doctors of science and 13 PhD, Associate professors.

The department offers 1 bachelor program in ecology and 3 Master programs: ecology, ecology and environmental protection and environmental control and audit. Also the department offers 1 PhD program.

Currently over 100 students and 7 postgraduates are studying at our Department.

GENERAL DESCRIPTION OF THE TRAINING MODULE

Level of study: *Master's*
Specialty: *Ecology*
Branch of knowledge: *Natural Sciences*
Title of Educational program: *Environmental control and audit*
Authors team:

1. Olena Popovych, Associate Professor, PhD.
2. Zoriana Odnorih, Associate Professor, PhD.
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DESCRIPTION OF THE COURSE № 1

Climate change adaptation strategy

Number of ECTS credits: 6

Type of course: compulsory

Summary of the course: The aim of the course is to study global climate change, which is one of the most pressing threats with long-term negative impact on the population, environment and economy.

Prerequisites for this course: Climate change and its impact on the social and economic development of the EU and Ukraine. Historical stages of formation of EU climate policy. International climate diplomacy. Cooperation between Ukraine and the EU in terms of fulfilling climate obligations. International climate negotiations.

Competences:

– Ability to solve complex specialized tasks and problems in the field of ecology, environmental protection and sustainable use of nature in professional activities or in the learning process, which involves research and / or innovation, and are characterized by complexity and uncertainty of conditions and requirements.

Learning outcomes:

– Demonstrate awareness of strategy for climate change adaptation and decision-making on risks and vulnerabilities to climate change for health, economic sectors and natural ecosystems.

List of lecture topics:

1. Introduction. Acquaintance with the project. Climatic change: why is it important?

2. Climate and climatic factors. Reasons for change climate

3. Historical stages of climate formation EU policy. International climate diplomacy.

4. Interaction between Ukraine and the EU in terms of implementation climate commitments

5. The role of the public and non - governmental organizations in combating climate change

6. Combating climate change at the community level and local governments

7. 7.Climate change and adaptation of living organisms to

8. Adaptation to climate change in the agricultural production sector.

9. Forest ecosystems as an element of regulation of global climate processes.

10. Ecosystem adaptation in NPF objects:strategies, examples, measures.

11. Problems faced by horticulture in connection with climate change.

12. Global distribution of introducers: "for and against".

13. Horticultural objects as an element of global climate regulation processes.

14. Directions of climate change mitigation (waste, energy, transport). Built-in concept environment.

List of practical classes, including laboratories, studios and workshops:

1. Manifestations of climate change in Ukraine.

2. International climate negotiations.

3. International public conservation organizations and their impact on the formation of climate decisions.

4. Ecological strategy of the city (study European cases).

5. Ecological strategy of the city (study of Ukrainian cases).

6. Resistance of living organisms to extreme temperatures, which are manifested in climate change. Rating heat resistance, cold resistance and frost resistance of plants.

7. Organic farming as a control lever agricultural production.

8. Ecosystem adaptation in biosphere reserves.

9. Decorative dendroflora and its role in formation of the microclimate of the city.

List of self-study topics:

1. Introduction. climate and climatology.

2. Analysis of progress in the approximation of climate legislation of Ukraine to EU requirements.

3. The role of public and non-governmental organizations in combating climate change.

4. Ecological and biological aspects of climate change.

5. Adaptation of agriculture and forestry to climate change.

6. Adaptation of the garden and park economy to changes climate.

7. Road map of climate goals of Ukraine until 2030 years.

DESCRIPTION OF THE COURSE № 2

Inspection Activities

Number of ECTS credits: 3

Type of course: optional course

Summary of the course: Inspection activities in the field of environmental protection have theoretical and applied aspects. The theoretical aspect is aimed at establishing patterns in the relationship between economic entities and the environment, and the applied aspect - the application of laws and regulations in environmental control. The purpose of teaching the discipline is to form students' knowledge of the system of supervision and control over various forms of nature management in Ukraine, as well as the skills of drawing up acts of verification of compliance with environmental legislation by legal entities and individuals.

Prerequisites for this course: Courses "Standardization and Prognostication of Industrial Pollution Emissions", "Evaluation of Environmental Impact", "Occupational and Civil Safety", "Research Methodology and Modeling of Processes of Industrial Waste Treatment".

Competences:

– Ability to solve complex specialized tasks and problems in the field of ecology, environmental protection and sustainable use of nature in professional activities or in the learning process, which involves research and / or innovation, and are characterized by complexity and uncertainty of conditions and requirements.

– professional competencies: ability to organize work related to the assessment of the ecological condition of economic entities, environmental protection and optimization of nature management.

Learning outcomes:

– Demonstrate knowledge of the modern regulatory framework in the field of environmental protection and nature management.

– Be able to assess compliance with environmental legislation in enterprises

List of lecture topics:

1. Purpose and tasks of the state ecological inspection. State and public, departmental and industrial environmental control. State Ecological Inspectorate of Ukraine and its territorial subdivisions. Rights and responsibilities of state inspectors. Legal framework, rights and responsibilities of public environmental inspectors.

2. Standards of time at check of observance of air protection and water protection legislation by the enterprises.

3. Planning and organization of the inspection by the state environmental inspector. Types and parts of inspections.

4. Preparing the company for inspection: the view of the head of the company and the environmental inspector. Documentation of the inspection. (Act of verification of compliance with the requirements of environmental legislation, Order,

Protocol or Conclusion on violation). Administrative and disciplinary measures. Property and criminal measures of influence.

5. Inspection of air protection activities of the enterprise. Inventory of stationary and mobile sources of pollutant emissions. Liability of an enterprise that releases pollutants into the atmosphere without a permit.

6. Check of water consumption and drainage. Inspection of water protection activities. Checking the sanitary condition of the site and potential sources of surface and groundwater pollution. Pollution of water bodies by excessive discharges.

7. Checking the use of land resources by an industrial enterprise. Types of inspections by the State Land Inspectorate. The procedure for inspections. Execution of documents based on the results of inspections.

8. Inspection of facilities for waste management issues.

List of practical classes, including laboratories, studios and workshops:

1. The list of documents when carrying out DEI of inspection of the enterprise concerning observance of requirements of the nature protection legislation of Ukraine.

2. Drawing up of the Act of inspection (acts of inspections, instructions, protocols and resolutions on violation of observance of requirements of the nature protection legislation).

3. Types of liability and application of measures of influence to violators of environmental legislation.

4. Calculation of penalties for damages caused by air pollution by the enterprise.

5. Calculation of penalties for damages caused by water management violations.

6. Determining the size of students due to violations of waste management requirements in the company.

7. Restriction or cessation of production activities. Termination of permits and the right to special use of natural resources.

List of self-study topics: N/A.

DESCRIPTION OF THE COURSE № 3

Analysis of anthropogenic factors of climate change

Number of ECTS credits: 6

Type of course: optionally

Summary of the course: The aim of this discipline is to study the anthropogenic factors of human activity that directly and indirectly affect the environment. Become familiar with the main methods of minimizing these impacts through the adoption of alternative energy sources and other environmental measures.

Prerequisites for this course: Course **"**Environmental impact assessment".

Competences:

– Acquire skills to assess the formation of greenhouse gases during the production and transportation of products and the impact of the gases formed on the environment.

Learning outcomes:

– With the help of software to determine the level of greenhouse gas formation in various processes of manufacturing, transporting and packaging products, and to model the process of operating and disposing of products

List of lecture topics:

1. Man's anthropogenic influence on the environment and its components.
2. Man-made aspects that have an impact on the environment.
3. The influence of the energy industry on climate change.
4. Modeling and prediction of factors of climate change
5. Software for the analysis of anthropogenic factors of climate change
6. Ways and methods to reduce the impact of negative impacts and climate change
7. basic principles of sustainable development for the implementation of climate management and governance
8. General approaches to adaptation to climate change.

List of practical classes, including laboratories, studios and workshops:

1. Analysis of the impact of human activities on the environment
2. Modeling of the impact of man-made objects on climate change
3. Evaluation of the energy potential of non-traditional energy sources in Ukraine
4. Calculation of the economic effect in the implementation of environmental and resource protection measures
5. Elaboration of an energy passport
6. Study of the characteristics of wind turbines

List of self-study topics:

1. Organic farming and prospects for its development in the world and Ukraine.
2. The concept and types of recycling. Types of waste suitable for use.
3. Foreign experience in waste management.
4. Criteria and indicators of Ukraine's transition to the model of sustainable development included in legal documents.
5. Regulatory conditions for the formation of a green economy in Ukraine.
6. Institutions implementing the state policy in the field of sustainable development.
7. The problem of transport, housing in cities. Water supply and drainage.

DESCRIPTION OF THE COURSE № 4

Analysis of anthropogenic factors of climate change, course project

Number of ECTS credits: 3

Type of course: optionally

Summary of the course: The aim of the discipline is to analyze the anthropogenic factors of human activities using software on the example of specific man-made objects that have direct and indirect effects on the environment.

Prerequisites for this course: Course "Environmental impact assessment".

Competences:

– The ability to analyze the impact of human activities and predict climate change.

Learning outcomes:

– Be able to use the latest methods and tools for environmental research.

List of lecture topics:

1. Man's anthropogenic influence on the environment and its components.
2. Man-made aspects that have an impact on the environment.
3. The influence of the energy industry on climate change.
4. Modeling and prediction of factors of climate change
5. Software for the analysis of anthropogenic factors of climate change
6. Ways and methods to reduce the impact of negative impacts and climate change
7. basic principles of sustainable development for the implementation of climate management and governance
8. General approaches to adaptation to climate change.

List of practical classes, including laboratories, studios and workshops:

1. Knowledge of the assignment for the course project and the methods used to complete it.

List of self-study topics:

1. Use of software to analyze the impact of man-made objects on the environment and the main factors of climate change.

DESCRIPTION OF THE COURSE № 5

The concept of sustainable development of state climate policy

Number of ECTS credits: 5

Type of course: optional course

Summary of the course: The aim of the discipline is to examine the concept of sustainable public policy development in the context of climate change. In this course, the material aims to train the knowledge and skills of future specialists in the

field of sustainable development in climate change, the concept of implementation of the state climate policy until 2030, the international experience of adaptation to climate change and its application in Ukraine, the impact of global climate change on land resources, agriculture, forestry, water resources, energy, infrastructure, biodiversity, public health, emergencies, as well as priority areas of state policy in Ukraine in the field of adaptation to climate change.

Prerequisites for this course: Courses "Climate change adaptation strategy", "Environmental impact assessment".

Competences:

– Be able to use the system of environmental standardization and certification to assess anthropogenic and natural pressures in order to carry out an ongoing assessment of the actual climate change to be expected and its consequences

Learning outcomes:

– Know the basic technologies of information exchange on sustainable development principles and strategies;

– Know the basic concepts of novelty of research in the field of sustainable development;

– Be able to group and analyze the effectiveness of measures to implement the concept of sustainable development, taking into account the current state of development. Be able to make suggestions for improving existing sustainable development strategies;

– Be able to predict the ecological footprint of technological processes and industries on the environment;

– Be able to analyze the state of sustainable development in countries using given indicators; use modern literature on social, economic and environmental issues of development.

List of lecture topics:

1. Sustainable development: essence, meaning, reasons and its preconditions.

1.1 The urgency of the problem of sustainable development.

1.2. The causes of the ideas of sustainable development.

1.3. The essence of sustainable development.

1.4. Preconditions for sustainable development.

1.5. The relationship of man and mankind with nature.

1.6. Basic principles of climate management and governance.

2. The influence of climate factors on industry (sectors).Climate. Factors affecting the climate. Characteristics and classification.Soil resources, agriculture, forestry.

2.3. Aquatic resources.

2.4. Energy.

2.5. Industry.

2.6. Infrastructure.

2.7. Biodiversity.

2.8. Population health and migration.

2.9. Emergency.

3. The role of the UN in defining the principles of sustainable development.

3.1. The United Nations system.

3.2. United Nations Conference on Environment and Development in Rio de Janeiro (1992).

3.3. Millennium Summit and Millennium Development Goals.

3.4. World Summit on Sustainable Development in Johannesburg (2002).

3.5. UN Millennium Development Goals Summit (2010).

4. Climate policy of Ukraine.

4.1. The essence of climate policy.

4.2. The components of climate policy.

4.3. Design and implementation of the state climate policy.

4.4. The financial component of climate policy.

5. International experience of climate change adaptation and the possibility of its application in Ukraine.

5.1. Standardization of adaptation measures to global climate change.

5.2. General approaches to climate change adaptation.

6. Green economy as a mechanism of implementation of the concept of sustainable development.

6.1. The concept of green economy, factors of its emergence.

6.2. The structure of the green economy.

6.3. Stimulating transformations towards green economy at global and international levels.

6.4. Business initiatives for the development of the green economy.

6.5. Green cities, prospects for their development in the world and Ukraine.

List of practical classes, including laboratories, studios and workshops:

1. The concept of the eco-city as a model for solving environmental problems.

2. Environmental problems of agriculture: soil pollution, desertification, soil erosion.

3. Mechanisms for the protection of forests.

4. The concept of a green economy.

5. Features of the introduction of green technologies in the basic sectors of the economy of Ukraine.

6. Examples of implementation of green economy projects in Ukraine**.**

List of self-study topics:

1. The essence of the concept of "globalisation": development rates and indicators.

2. Transnational corporations (TNCs) and their impact on the economy and social development of the world.

3. Analysis of the demographic situation in relation to countries: identification of the main problems.

4. Green Revolution: origins, results, prospects.

5. Directions and mechanisms of the state policy of waste management in Ukraine.

6. Energy efficiency of the economy and the main directions of its increase.

DESCRIPTION OF THE COURSE № 6

Climate management

Number of ECTS credits: 4

Type of course: optionally

Summary of the course: The aim of teaching in the discipline of "Climate Management" is an in-depth study of the impact of climate change on various sectors of the economy and the identification of possible promising ways to develop the economy, taking into account environmental risks. The discipline includes the study of methods that reduce the negative impact of climate change on economic development and the development of development strategies in Ukraine associated with the mitigation of climate change and adaptation of various sectors of the economy to its consequences.

Prerequisites for this course: Courses “Meteorology and climatology”, “Evaluation of environmental impact”, “Standardization and prognostication of industrial pollution emissions”.

Competences:

– Ability to solve complex specialized tasks and problems in the field of ecology, environmental protection and sustainable use of nature in the implementation of professional activities or in the learning process involving research and/or innovation and characterized by complexity and uncertainty of conditions and requirements.

– Acquire knowledge about the consequences of climate change and possible adaptation measures by society through effective public management.

Learning outcomes:

– Be able to identify environmental risks related to climate change based on monitoring studies and develop strategies for their effective management.

– Know current trends and development strategies of Ukraine and other countries related to climate change mitigation and adaptation.

– Know innovative technologies that can be applied in different sectors of the economy to reduce the impact of climate change on the environment.

– Be able to provide effective technological solutions to address environmental risks associated with climate change.

– Be able to develop a long-term industrial development plan aimed at mitigating climate change and adapting to the impacts of existing climate change.

– Be able to analyze the effectiveness of measures for effective management and the introduction of new technologies to reduce the industry's impact on the environment and the climate in general.

List of lecture topics:

1. Global climate change. Causes of climate change. Scenarios of climate change up to the middle of the 21st century.

2. The impact of climate change on the most vulnerable sectors of the economy: agriculture, forestry and water management.

3. The implications of climate change for the energy sector.

4. The public health implications of climate change/

5. International experience of climate change adaptation and the possibility of its application in Ukraine.

6. European Union Climate Change Adaptation Strategy (COM / 2013/0216).

7. State policy on climate change.

8. Priority actions for climate change adaptation.

9. General approaches to climate change adaptation: national, regional and local levels.

10. Standardization of adaptation measures to global climate change.

11. Instruments for adaptation to climate change at the international level.

List of practical classes, including laboratories, studios and workshops:

1. The modern climate of Ukraine and its geological and historical changes.

2. The current climate change, its effects and consequences at the national and regional levels.

3. Global models in the study of modern climate and its future changes.

4. Individual regional models and their ensembles.

5. Scenarios of climate change up to the middle of the 21st century.

6. Adapting to climate change: towards a European framework action plan.

7. Ukrainian legislation in the field of climate change adaptation.

List of self-study topics:

1. Modern warming: key causes and trends in climate indicators.

2. The concept of global climate models, the main blocks they contain.

3. Modern processes of adaptation to climate change.

4. Climate change adaptation measures in the energy sector, transport system, agriculture, ect.