

Syllabus

Course Title

Climate Change: Causes and Consequences

General Information

General description of the required education/training, outlining the main objectives and explaining the necessity of the education/training at the organizational/country/regional level

The course “Climate Change: Causes and Consequences” is one of the core courses of the Master’s degree program “Climate Change Mitigation and Adaptation.” The main objective of the course is to train specialists in the field of climate research, observations, and their processing, whose role is to assess the dynamics of current climate threats and the emergence of new climate threats associated with climate change.

Climate change is one of the most pressing issues of our time, requiring a comprehensive approach to understanding, adaptation, and mitigation of its consequences. Education and training in this field play a key role in developing a scientifically grounded strategy for action at the level of organizations, regions, and the state.

Main Learning/Training Objectives:

1. Increasing awareness – familiarization with the basic scientific concepts related to climate change, greenhouse gases, and global warming.
2. Developing monitoring skills – training in methods of collecting and analyzing climate change data, as well as the use of modern technologies and observation systems.
3. Developing adaptation competencies – preparation for the implementation of climate change adaptation measures in various sectors of the economy.
4. Developing mitigation measures – training in effective methods of reducing greenhouse gas emissions in industry, energy, agriculture, and transportation.
5. Promoting environmental culture – increasing the environmental responsibility of the population and organizations.

The necessity of this training at the organizational level will provide employees with knowledge of energy conservation and reducing the carbon footprint of companies. It will create opportunities for integrating environmentally friendly technologies into production processes and will enable the use of climate data for long-term strategic planning.

At the regional level, it will make it possible to analyze regional climate risks and their impact on the economy and ecosystems. It will facilitate the implementation of local environmental sustainability initiatives and support research programs and innovations in the field of climate technologies.

At the national level, it will ensure the fulfillment of international commitments regarding the reduction of greenhouse gas emissions. It will stimulate

the development of state policy aimed at combating climate change and the creation of training programs for specialists in climate services and renewable energy.

A comprehensive approach to education and training in the field of climate change is an important step toward environmental stability and sustainable development. Education based on scientific research and modern technologies will make it possible to respond effectively to climate challenges and reduce their negative impact on society and nature.

Audience

The main target audience of the course and any secondary audience, if it may influence decisions regarding the structure or content of the course

Expected level of knowledge and skills of the main audience (current or minimally required), as well as other factors (for example, cultural characteristics, level of technical training, access to the Internet) that should be considered when planning the course, as they may affect the choice of teaching methods, materials, and approaches to interaction with the audience

The primary audience consists of Master's students of higher education institutions in Ukraine who are pursuing education in the field of climate services. The course may also be partially used as a professional development course for specialists of the national hydrometeorological service, employees of government institutions, and professionals in the fields of economics, healthcare, public utilities, and regional planning who require knowledge of climate threats in order to develop adaptation strategies within their respective sectors. It is also intended for environmental specialists and environmental protection organizations working on climate change mitigation and adaptation to new conditions. Scientists and university lecturers who study climate change may integrate the acquired knowledge into educational programs.

Secondary audience: media and public organizations, which ensure the dissemination of information among the population and contribute to raising awareness of climate-related issues; the private sector (businesses, corporations, and the agricultural sector), which can adapt their business models and implement sustainable solutions to reduce their impact on the climate.

Expected Level of Knowledge and Skills of the Primary Audience

Fundamental knowledge: basic knowledge in the field of natural sciences; understanding of climate change and its impacts on ecosystems and the economy; knowledge of the main sources of climate data.

Analytical preparation: ability to work with climate data; ability to analyze climate risks; knowledge of statistical methods for climate risk assessment.

Technical preparation: basic computer and Internet skills; access to interactive learning platforms (e.g., Moodle); basic skills in data analysis, presentations, and Excel are desirable.

English language proficiency: an intermediate level of English (B1 or higher) is recommended for working with international research, reports, and models.

Other Factors Affecting the Learning Process

Level of Internet access: possibility of blended learning (online + offline); development of interactive learning materials.

Accessibility of materials: use of visualizations and applied case studies; adaptation of materials (large-print texts, audio files, or files compatible with screen-reading software) to different levels of learner preparation, including learners with special needs.

Competencies

Training needs at the individual or organization/country/regional level, as well as a description of how these needs were identified and recognized as relevant.

Competencies targeted by the training.

C1. Formulate and illustrate the complex interrelationships among the various components of the nonlinear Earth system.

Learning outcomes and performance criteria

Learning outcomes and performance criteria formulated with regard to the knowledge and skills to be acquired during the training process.

Learning outcomes:

LO3. Identify and describe the main causes of climate change, including both natural and anthropogenic factors, and illustrate how these causes contribute to global warming and climate variability.

LO4. Explain the main consequences of climate change for water and food resources, energy consumption, and economic growth.

Performance criteria: demonstrate the ability to clearly communicate the causes and consequences of climate change in written reports and oral presentations, using accurate data and examples from real-world case studies.

Course Content

Provide a content outline that corresponds to the learning objectives and outcomes. This may be a course outline as it will be presented to students, but not necessarily a complete curriculum.

Include a general list of all topics that you consider necessary to cover. If you believe it would help clarify the scope, indicate what will NOT be covered.

Module 1: Causes of Climate Change

The main causes of climate change, including natural and anthropogenic factors, are identified and described, and it is illustrated how these causes contribute to global warming and climate variability.

Module 2: Consequences of Climate Change

The main consequences of climate change for water and food resources, energy consumption, and economic growth are explained.

Learning Solutions and Methods of Implementation

List the learning solutions (teaching methods) that will be used and explain why they were chosen. For example: classroom learning, online learning, blended learning, workplace learning, online resources for self-study, coaching or mentoring, etc.

Learning Format.

Blended learning with an emphasis on the asynchronous online component and regular face-to-face reflection sessions.

Master's students are offered a blended learning approach, in which the main theoretical material is studied asynchronously online, while practical and analytical skills are developed during face-to-face sessions with the instructor in the classroom.

This approach takes into account:

- the high level of motivation and autonomy of Master's students in planning their own learning time;
- the need for in-depth acquisition of complex knowledge, which requires live practice and discussion;
- educational needs that can be more effectively addressed through the involvement of external experts in online sessions.

During asynchronous learning (online module), students: study video lectures, presentations, and recommended literature; participate in discussion forums related to the course topics. One or two times per week, the instructor conducts face-to-face sessions aimed at reinforcing knowledge through practical exercises, scenario modelling, case studies, and discussions.

For deeper assimilation of the material, it is advisable to organize synchronous online activities, namely guest lectures delivered by experts in the field to analyze case studies or address issues requiring further clarification.

Upon completion of the course, a final assessment will be conducted. The assessment will be based on a comprehensive evaluation of both knowledge and practical skills through tests, projects, and the presentation and defense of practical assignments.

Learning Strategies

Consider which learning strategies you will use. Provide justification for why you intend to apply them, including reasons why they will help participants achieve the planned learning outcomes.

Combine different learning strategies to create a diverse learning environment that accommodates different learning styles of participants. This will increase the effectiveness of learning and help achieve the planned learning outcomes. This section does not require a detailed description of specific activities.

The following learning strategies are planned to be used during the course delivery.

Lecture strategy – the instructor helps students understand new or controversial concepts that are difficult to master independently.

Discussion strategy – enables learners to gain practical experience in collaborative participation in discussions and in solving theoretical and practical problems.

Case study strategy – allows students to investigate complex, interdisciplinary relationships in conditions that are close to real-life situations. In the context of Competency C1, the case study method provides an opportunity to model nonlinear processes and interdependencies, for example between temperature change, precipitation, agricultural production, and economic development; to apply analytical thinking and a systems approach to the assessment of climate scenarios; and to examine complex situations with multiple variables, which is characteristic of the Earth's climate system.

Inquiry-Based Learning (IBL) strategy – focuses students not on passive reception of knowledge, but on active formulation of questions, and the search, analysis, evaluation, and interpretation of data from different sources. This strategy is highly effective for developing a deep understanding of complex natural and social phenomena, in particular climate change. Students independently analyze scientific publications, climate models, and databases such as IPCC and NASA GISS, and learn to identify consistencies and contradictions between sources.

Learning Activities

Describe the main learning activities that will be included, such as lectures, readings, case studies, discussions, exercises, practical assignments, simulations, role-playing games, etc.

Also describe the roles of instructors and students during these activities.

Course structure: this course consists of lectures and practical classes (40% of the total workload) and students' independent work (60%). Each module includes 12 academic contact hours and 18 hours of independent study. Contact hours include 2–3 lectures, while the remaining time is allocated to practical classes.

Organization of learning: the main form of instruction is the lecture, which introduces the course. The first lecture familiarizes students with the instructors, the aims and structure of the course, and demonstrates the connection between theoretical knowledge and practical tasks. The instructor presents the glossary, provides a list of recommended sources, and explains the conditions for ongoing and final assessment.

The lecture is scientific and informative in nature; it is supported by justification and includes examples, facts, and documents; it stimulates students' thinking through questions; it has a clear structure and logical sequence of presentation; it explains new terms and highlights key points and conclusions; repetition of main conclusions in different formulations is used.

In the final lecture, the instructor summarizes the studied material, systematizes knowledge, and explains complex examination questions.

The course includes *practical classes*, which deepen the processing of course material and play a key role in developing students' ability to apply theoretical knowledge to practical problems. They also allow the instructor to support learning and monitor students' level of understanding.

Practical work includes individual and group assignments, exercises and problem-solving tasks, development of teamwork skills, and conducting research with analysis of results.

Independent work is an essential component of the learning process and a key factor in the effectiveness of classroom instruction. Its effectiveness is ensured through clear planning, allocation of sufficient hours in the curriculum, and instructor supervision. The aim of independent work is not only to master course content, but also to develop the ability to work autonomously in academic, scientific, and professional contexts. It contributes to the development of responsibility, independent decision-making, and the ability to find constructive solutions to problems and crisis situations.

Independent work of students includes preparation for lectures, practical classes, and assessments, completion of part of the practical assignments, and study of additional sources to deepen knowledge.

Roles of participants in the learning process.

The role of the instructor in lectures is to provide overall guidance of the learning process and to select teaching methods and strategies. During practical classes, the instructor acts as an instructor or supervisor, defining the content and direction of practical tasks. Throughout the course, the instructor provides both scheduled and unscheduled consultations.

The role of the student is to acquire knowledge, skills, and competencies in practical work and teamwork while completing tasks assigned by the instructor. This contributes to the student's preparation for future professional activity.

Assessment of Learning

Describe the assessment plan for participants before, during, and/or after the course, including tests, exercises, activities, and projects that will be assessed. Indicate whether self-assessment or peer assessment will be used.

Explain how the assessment is linked to the learning outcomes.

Before the start of the course, an entry assessment is conducted – an initial evaluation of students’ knowledge. Its purpose is to determine the level of learners’ preparation and to check their mastery of the basic knowledge required for successful completion of the course. The results of the entry assessment allow the instructor to identify the educational needs of each student. The assessment may be conducted in a distance format via the e-learning platform.

Further assessment is carried out using a modular system. The course is divided into two logically connected theoretical modules, the first of which is graded with a maximum of 30 points, and the second with 20 points. Assessment is carried out in the form of online testing. The theoretical test for Module 1 contains 30 questions, and for Module 2 contains 20 questions.

The levels of knowledge acquisition are defined as follows:

- 50–74% correct answers – sufficient (minimum) level;
- 75–89% – good level;
- 90–100% – excellent level.

Testing allows assessment of the degree of theoretical knowledge acquisition and enables timely identification of knowledge gaps.

Practical classes are conducted under the supervision of the instructor during contact hours defined in the syllabus. Tasks and supporting materials for their completion are provided on the e-learning platform.

Completed practical assignments are uploaded by students to the platform for assessment and feedback from the instructor. Evaluation is carried out according to learning outcomes and the quality of task completion. Throughout the course, **five practical assignments** are planned: two in the first module and three in the second module.

Assessment levels are defined as follows:

- Sufficient (minimum level) – the student completed the task with the instructor’s support (6 points).
- Good level – the student completed all tasks independently but without presentation (8 points).
- Excellent level – the student completed all tasks independently (8 points), presented the results in the form of a presentation (+2 points), and successfully answered the instructor’s questions during the defense of the work.

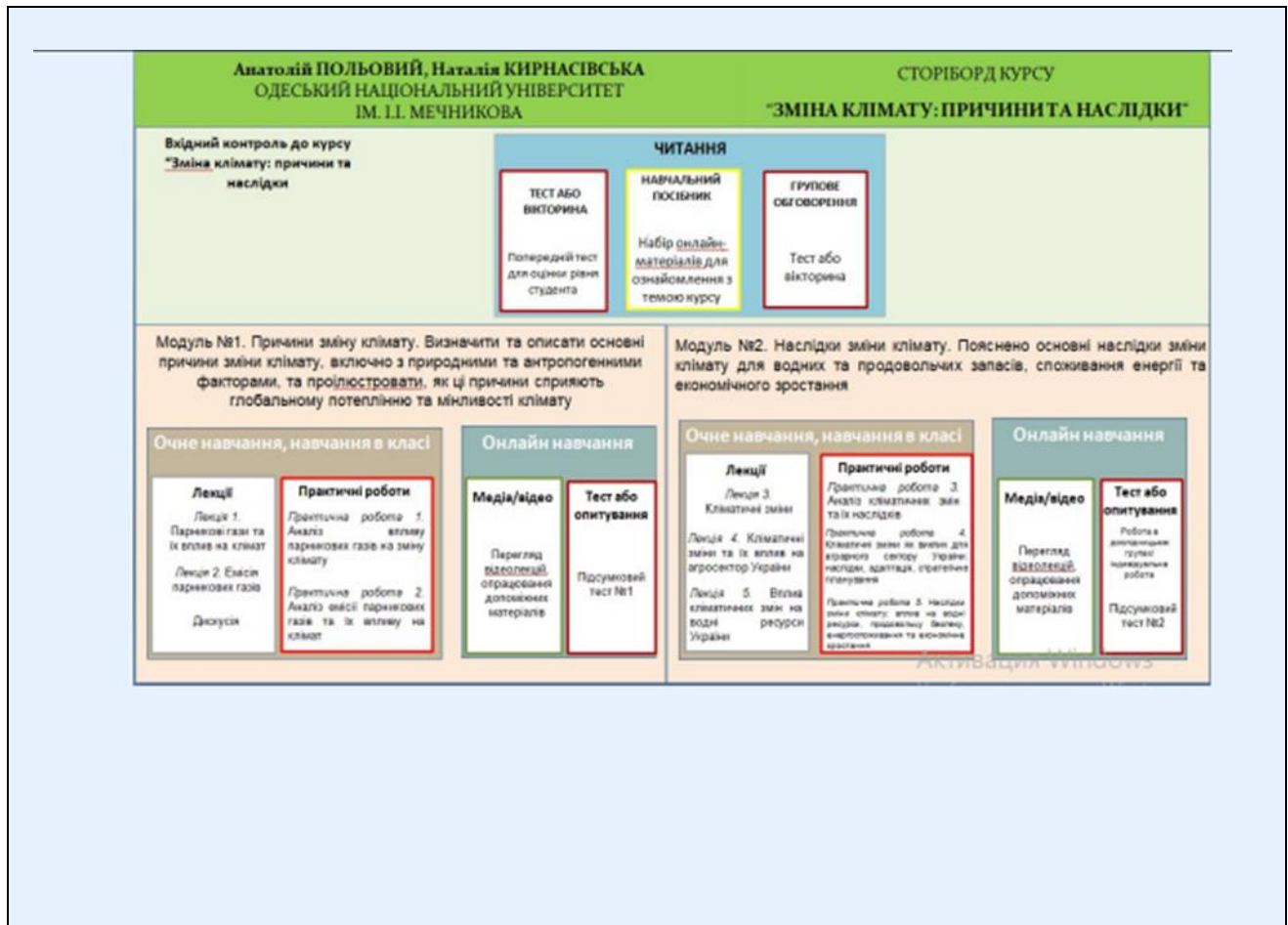
The final grade is formed by summing the results of all modules (points from theoretical and practical components), taking into account:

- the weight of each module in mastering fundamental knowledge and skills;
- the regularity of completing assessment tasks within the established deadlines.

The **maximum total score for this course is 100 points**

Storyboard of Learning (Learning Storyboard)

Use this to create a visual scenario of your blended learning activity



Learning resources and tools

List the available resources that will be used for different types of learning activities and recommended to students.

Describe the technologies that will be used to implement learning solutions, including educational technologies and operational equipment (hardware, software, collaboration tools).

1. Access to learning materials – video lectures, presentations, and additional informational resources will be made available on the Moodle platform, allowing students to familiarize themselves with the material before lectures and practical classes.
2. Access to online resources – students will have the opportunity to use open and specialized online information resources, including databases, scientific articles, and analytical reports.
3. Online lectures and communication – lectures and interactive sessions will be conducted via MS Teams, providing the opportunity to communicate with the instructor in real time, participate in discussions, and engage in teamwork on projects.

4. Presentation materials – learning content will be provided in the form of PowerPoint presentations, which will help structure the information and support students in preparing their own presentations and projects.
5. Additional tools – interactive platforms for testing, data analysis, and modelling may be used during the course, which will support the practical acquisition of knowledge.