Syllabus

Course Title

Climate Change Mitigation and Adaptation: Case Studies and Best Practices in the Construction Sector

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 Mitigation and Adaptation: Case Studies and Best Practices in the Construction Sector" is designed to develop a systemic understanding among construction professionals of the interplay between building design, operation, and climate change.

Changes in climate conditions—such as rising average annual temperatures, increased frequency of extreme weather events, uneven precipitation, and other manifestations of global warming—directly affect the durability, energy efficiency, and safety of building infrastructure. The need for this training arises from the imperative to implement innovative solutions in design and construction practice that reduce greenhouse gas emissions, enhance the resilience of structures to climate risks, and promote efficient resource use.

At the organizational level, the course prepares engineers, architects, and managers to apply modern carbon footprint assessment methods, design projects considering climate change scenarios, and implement proven mitigation and adaptation practices. At the national and regional level, it supports the implementation of governmental and local strategies for decarbonization, energy security, and climate adaptation, enhancing the competitiveness of the construction sector and reducing socio-economic losses from climate impacts.

The course aims not only to impart theoretical knowledge but also to train participants to analyze real-world cases and integrate the best international and national practices into their professional work. This approach is crucial for ensuring the sustainable development of the construction sector in the face of global climate challenges.

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

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considered when planning the course, as they may affect the choice of teaching methods, materials, and approaches to interaction with the audience

The course is designed for second-cycle (master's level) students in the G2 specialty "Environmental Protection Technologies" (EPT) who seek to enhance their professional qualifications, complete tasks requiring demonstration of competencies, and achieve learning outcomes defined by higher education standards.

Secondary audience: instructors, research supervisors, community leaders, and representatives of professional associations who influence educational standards, sectoral requirements, or support the development of student competencies.

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.

C5. Based on economic assessments, provide action-oriented recommendations for the development and improvement of adaptation and mitigation strategies that enhance resilience and reduce adverse impacts.

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.

LO1. Critically evaluate mitigation strategies relevant to the construction sector, analyzing their potential to reduce greenhouse gas emissions and the challenges associated with their implementation.

LO4. Integrate knowledge from multiple disciplines, including economics, policy, science, and technology, to develop comprehensive and effective solutions to climate change.

LO6. Integrate knowledge of sector-specific mitigation strategies, adaptation measures, and best practices to develop comprehensive climate action plans tailored to specific geographic regions, economic sectors, or communities.

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.

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Module 1: Assessment of Climate Change Mitigation Strategies in the Construction Sector

- Lecture 1: Climate change: challenges and opportunities for the construction sector.
- Lecture 2: Climate change mitigation strategies in the construction sector: overview and key approaches.
- Lecture 3: Challenges and barriers to implementing building strategies for climate change mitigation.

Module 4: Integration of Interdisciplinary Knowledge

- Lecture 1: The role of integrating economics and public policy in the construction sector to develop comprehensive and effective climate change solutions.
- Lecture 2: Smart development of green construction: integrating technologies in the construction sector for climate change mitigation.

Module 6: Developing Climate Action Plans Considering Specific Conditions

- Lecture 1: Energy efficiency and climate policy in Ukraine's construction sector: strategic goals and regulatory framework.
- Lecture 2: Integrating green building practices in Ukraine for climate change mitigation.

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.

For master's level training, a variety of teaching methods are applied to ensure a balance between theoretical knowledge acquisition and practical skill development. The main methods include:

- **Classroom learning** – used for active discussion of complex concepts, case analysis, debates, and development of critical thinking. This format supports the growth of professional communication skills, argumentation, and interpersonal interaction, which are essential for future academic, pedagogical, and professional activities.
- **Distance learning** – employed for timely consultations, focused study of individual topics, and independent work with materials. Full online delivery is applied only under critical circumstances (pandemics, military risks), as this

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mode limits opportunities for non-verbal communication and experience sharing.

- **Independent work outside the classroom** – includes studying scholarly publications, video materials, presentations, and other sources. This form develops skills in critical analysis, evaluation of information reliability, identification of research gaps, and formulation of independent conclusions.
- **Interactive resources and mentor support** – include online resources, coaching, and mentoring to deepen understanding of complex topics and develop competencies in interdisciplinary areas.

This combination of methods ensures comprehensive master's level training aimed at developing analytical, research, and communication competencies necessary for effective professional and academic performance.

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.

For master's-level education, a variety of instructional strategies are employed to align the learning process with the real-world professional environment of future researchers and educators, while fostering the development of advanced competencies such as critical analysis, analytical thinking, innovation, effective communication of ideas, and collaborative teamwork.

The main instructional strategies include:

- **Lectures** – provide foundational knowledge on climate change, its impacts on various sectors, and contemporary approaches to adaptation and mitigation.
- **Case Study Analysis** – enables learners to examine specific examples of successful and unsuccessful responses to climate change, helping them avoid repeating past mistakes and draw practical conclusions.
- **Discussions and Brainstorming** – foster creative thinking, argumentation skills, analysis of others' ideas, and evidence-based decision-making in the field of climate change adaptation. This approach encourages the generation of new ideas that can be applied in master's research projects or future professional practice.

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- **Inquiry-Based Learning** – promotes deep engagement with climate change adaptation and mitigation processes at different levels, while addressing students' individual learning needs and interests.
- **Independent Reading and Literature Analysis** – involves the study of peer-reviewed scientific articles, book chapters, and electronic resources, with a critical approach to evaluating the reliability and validity of information.

The combination of these strategies creates a diverse learning environment that accommodates different learning styles among master's students, enhances the effectiveness of knowledge acquisition, and supports the achievement of the intended learning outcomes.

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.

The learning process combines lectures, practical sessions, and independent study with a variety of learning activities, including case analysis, discussions, case studies, inquiry-based problem solving, and the review of scientific literature.

Distribution of learning time:

- **Lectures – up to 16%:** The instructor is responsible for delivering foundational knowledge, developing a conceptual understanding of the topics, and facilitating discussion. Students' role primarily involves active listening and asking questions.
- **Practical sessions – 24%:** Students take the leading role by conducting situational analyses, discussing case studies, and proposing solutions. The instructor acts as a consultant and mentor, guiding the process and helping to refine approaches.
- **Independent study – 60%:** Students engage with scientific literature, electronic resources, and prepared learning materials, while completing individual assignments that foster critical analysis and research skills.

The combination of these activities ensures the integration of theoretical knowledge with practical skills, promotes active participation by master's students, and supports the development of competencies essential for both professional and academic careers.

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.

Assessment of master's students is conducted **before, during, and after the course** to evaluate the achievement of intended learning outcomes and the development of analytical, critical thinking, and research competencies. The following assessment methods are employed:

1. **Quizzes and Surveys** – short assessments consisting of multiple-choice questions or yes/no formats, enabling rapid evaluation of learners' understanding of fundamental concepts and terminology.
2. **Critical Review** – preparation of an analytical review of a specific climate change–related issue, requiring students to present and justify their own position using relevant literature, while also acknowledging potential counterarguments.
3. **Case Analysis** – development of a short manuscript or presentation based on a given scenario, including projections of future developments and evaluation of potential consequences in the context of climate change.
4. **Thinking Examination** – completion of a written assignment within a specified time frame (typically three hours), with flexible allocation of time: one hour for idea generation and brainstorming, followed by two hours for structuring and writing a manuscript on a designated topic.

In addition, **self-assessment** and **peer assessment** may be incorporated to foster critical thinking and strengthen students' ability to evaluate the work of their peers.

Each assessment method is aligned with specific learning outcomes, ensuring a comprehensive evaluation of students' knowledge, analytical capabilities, and practical skills.

Storyboard of Learning (Learning Storyboard)

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

C5 LO1
Критично оцінити стратегії пом'якшення наслідків, що відповідають будівельній галузі, аналізуючи їх потенціал для зменшення викидів парникових газів та проблеми реалізації

Очна форма, аудиторія

Лекції

Навчальні матеріали (презентації, лекції, книги)

Огляд сучасних підходів до пом'якшення змін клімату в будівельній галузі. Аналіз викликів та бар'єрів їх впровадження

Практика під керівництвом та зворотний зв'язок

Практичні вправи

Обробка та аналіз кліматичних даних на основі прогнозів *CMIP6* та Інтерактивного атласу клімату Коперника (C3S Atlas)

Практичні вправи

Оцінка життєвого циклу (*LCA*) та розрахунок вуглецевого сліду будівель

Кейс орієнтований захід

Кейс стаді

Аналіз та модернізація будівель для підвищення енергоефективності та інтегрування відновлювальних джерел енергії

Онлайн навчання

Онлайн заходи

Навчальні онлайн матеріали

Читання цифрових книг, статей, мультимедіа, вебсайтів, нормативних документів та ресурсів

Тестові завдання

Тест на самооцінку

☑ Оцінювання

Медіа/Відео

Відео-матеріали

Перегляд відеоматеріалів про вплив будівельної галузі на зміну клімату та ключові стратегії адаптації

C5 LO4
Інтегрувати знання з різних дисциплін, включаючи економіку, політику, науку та технології, щоб розробити комплексні та ефективні рішення для зміни клімату

Очна форма, аудиторія

Лекції

Навчальні матеріали (презентації, лекції, книги)

Лекції про інтегрування основ економіки, державної політики та інноваційних технологій у будівельній галузі для розробки рішень щодо зміни клімату

Обговорення

Відкриті дискусії

Дебати у форматі Сократівського семінару для аналізу взаємозв'язку між урядовою політикою та стратегіями адаптації будівельної галузі до змін клімату

Структуровані дискусії

Дискусія щодо впровадження штучного інтелекту в будівництві, оцінка його впливу на якість, терміни, витрати проектів та перспективи інтегрування інноваційних технологій

Практика під керівництвом та зворотний зв'язок

Практичні вправи

Аналіз наукової літератури та узагальнення даних щодо штучного інтелекту та машинного навчання у сфері енергоефективності та скорочення викидів вуглецю

Онлайн навчання

Онлайн заходи

Навчальні онлайн матеріали

Читання цифрових книг, статей, вебсайтів, нормативних документів про інтегрування міждисциплінарних знань для розробки кліматичних рішень

Тестові завдання

Тест на самооцінку

☑ Оцінювання

Медіа/Відео

Відео-матеріали

Перегляд відеоматеріалів про роль штучного інтелекту в оптимізації енергоспоживання будівель

C5 LO6
Інтегрувати знання про секторальні стратегії пом'якшення наслідків, заходи з адаптації та найкращі практики для створення комплексних планів дій щодо зміни клімату, адаптованих до конкретних географічних регіонів, економічних секторів або громад.

Очна форма, аудиторія

Лекції

Навчальні матеріали (презентації, лекції, книги)

Лекції про енергоефективність та кліматичну політику в буд. секторі України, а також інтегрування зеленого будівництва для пом'якшення зміни клімату

Кейс орієнтований захід

Рольові ігри в класі

Проведення рольової гри за участю розробників проєктів із впровадження кліматичних заходів у будівельному секторі України та інвесторів

Кейс стаді

Проведення аналізу розроблених кліматичних проєктів в будівельній галузі

Проєктно-орієнтований захід

Проєкт

Розробка кліматичного плану для будівельного сектору України або окремого міста. Створення презентації міні-проєкту кліматичного плану

Обговорення

Відкриті дискусії

Дебрифінг проєктів: оцінка досягнутих цілей проєкту; аналіз труднощів та викликів під час реалізації; обговорення ефективності прийнятих рішень; розроблення рекомендацій

Онлайн навчання

Онлайн заходи

Навчальні онлайн матеріали

Читання цифрових книг, статей, вебсайтів, нормативних документів про кліматичну політику в Україні

Тестові завдання

Тест на самооцінку

☑ Оцінювання

ClimEd

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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).

To implement the learning design, a variety of resources and technologies will be used to ensure effective knowledge acquisition and the development of practical skills among master's students:

1. Learning resources:

- Peer-reviewed scientific articles, monographs, textbook chapters, and methodological materials.
- Electronic resources and databases (Scopus, Web of Science, Springer, Google Scholar).
- Video materials, presentations, and infographics supporting both classroom and independent learning activities.
- Case studies and examples of real-world projects in the construction and climate sectors.

2. Educational technologies and tools:

- Platforms for distance and blended learning (Moodle).
- Collaboration and discussion tools (Google Workspace, Miro, Padlet).
- Data analysis and climate process modelling software.
- Technical equipment for practical and laboratory work, including computers, multimedia projectors, interactive whiteboards, and specialized laboratory devices.

These resources and tools ensure the integration of theoretical knowledge with practical skills, support active student engagement in the learning process, and contribute to the development of critical thinking, research competencies, and interdisciplinary collaboration.