



Ministry of Education and Science of Ukraine
Chernihiv Polytechnic National University
*Educational and Scientific Institute of Management, Food
Technology and Trade*
Department of food technology and ecology
Course Programme
**CK 9 – Smart Cities and Climate Adaptation and
Mitigation Strategies**

Approved by
The Head of the Department

Y. Yemchuk B.M.
(signature) (surname and initials)

« 04 » 06 2024.

Course Developer(-s): Buialska N.P., Associate professor of the Department of food technology and ecology, PhD

(signature)

The course schedule was discussed at the meeting of the Department of Food Technology and Ecology

Protocol of « 04 » 06 2024. No. 6

Agreed with the guarantor:

(signature)

S.D. Tsiulya
(surname and initials)

1. General information about the course.

Course type	Compulsory
Teaching language	English
Year of study and semester	1 st and 2 nd year (2 nd and 3 rd semesters) Master's programme in Environmental Safety
Examiner(s)	Buialska Nataliia Pavlivna, Associate professor, PhD
Examiner(s) profile	https://scholar.google.com.ua/citations?hl=uk&user=wS15YTYAAAAJ
Examiner's contacts	buialska@gmail.com

2. Annotation. The course will provide insights into the key concepts related to smart cities, with a particular focus on their relation to climate adaptation and mitigation strategies. These strategies are geared toward the municipalities, and urban stakeholders across city sectors, including industries, property owners, utilities, and households. The course based on a multidisciplinary approach, including environmental, technological, economic and social aspects. Using this approach, the course investigates and explores the potentials of smart city technologies in relation to the challenges associated with implementing mitigation and adaptation strategies.

3. Course Aims. To form an understanding of the concept of a smart city and the opportunities that can be provided to cities for mitigation and adaptation to climate change, as well as to develop practical skills for the implementation of modern smart technologies at the local level.

When studying the educational component, master's student gets:

general competencies:

GC 02. Ability to make sound decisions;

GC 03. Ability to generate new ideas (creativity);

GC 04. Ability to develop and manage projects;

special competencies:

SC 09. Awareness of the latest achievements required for research and/or innovation activities in the field of natural environment, environmental protection and ecology;

SC 10. Ability to apply interdisciplinary approaches in critically understanding environmental issues;

SC 11. Ability to use principles, methods and organizational procedures of research and/or innovation activities;

SC 14. Ability to manage the strategic development of a team in the process of implementing professional activities in the field of natural environment, environmental protection and ecology;

SC 15. Ability to organize work associated with environmental assessment, environmental protection and environmental management optimization in conditions of incomplete information and conflicting requirements;

SC 17. Ability to independently develop environmental projects through the creative application of existing and new ideas.

4. Learning outcomes. While studying the course, the master's student achieves or improves the following learning outcomes provided by the Master's programme:

LO 02. Be able to use basic environmental regularities in professional activities.

LO 04. Know the legal and moral norms for assessing professional activities, developing and implementing socially significant environmental projects in the face of conflicting requirements.

LO 05. Demonstrate the ability to organize teamwork and implement complex environmental projects taking into account available resources and limitations.

LO 10. Demonstrate awareness of the latest principles and methods of environmental protection.

LO 16. Choose the optimal management strategy and/or nature management depending on environmental conditions.

LO 20. Have a basic understanding of environmental engineering design and environmental expert assessment of environmental impact.

5. Prerequisites. Studying this course requires successful completion of the course "Current global challenges".

6. Course disposition.

Type of activity	Total number of hours
Lectures	16 hrs
Practical works	16 hrs
Independent work	88 hrs
Project	120 hrs
Individual task –	
ECTS credits – 8	

The format of classes: lectures, practical work, independent work using the Moodle distance learning system and literature.

7. Course content.

Lecture topics

Topic 1. Cities and technological change

The concept of sustainable development in the context of a cities-based approach. Urban technological innovation. Fourth industrial revolution, robotics and artificial intelligence: adaptation

opportunities for cities and needs for urban environments. Key attributes and characteristics of smart cities.

Topic 2. Climate mitigation and adaptation strategies on a local level

Urbanization and climate change. Changing the city's carbon footprint. Urban options for climate mitigation. Climate change adaptation strategies: nature-based solutions, financing adaptation, closing the adaptation knowledge gap, adaptation in the insurance sector.

Topic 3. Urban analytics

Concept of urban analytics. Urban analytics challenges and opportunities. Urban spatial networks. Big data in urban analytics. Urban analytics in urban planning. Smart cities and urban analytics.

Topic 4. Urban metabolism. Urban energy systems

The concept of an urban metabolism. Approaches for assessing urban metabolism. Urban metabolism applications at the city-level. Urban metabolism challenges and opportunities. Current status of urban energy systems. Development trends in urban energy efficiency for climate change mitigation. Environmental efficiency of urban energy generation.

Topic 5. Social innovation and sharing economy

Key sectors of the sharing economy and its impact on urban functions. Sharing economy models for smart cities. Social Innovation for Environmental Sustainability. Smart cities and social innovations.

Topic 6. Challenge driven innovation in urban planning. Smart building

Dimensions and principles of urban planning. Introduction to smart buildings. Technologies for smart buildings. Energy efficiency in smart buildings. Local energy production. Smart management of heating, ventilation, air conditioning and lighting. Smart waste management.

Topic 7. Smart mobility

Objectives of smart mobility. Innovative mobility solutions. Smart mobility challenges. Urban smart mobility for climate mitigation. Case studies of smart mobility solutions in an urban area.

Topic 8. Cybersecurity, weaknesses and responses

Cyber Challenges for smart cities: cybercrime, cyber-attacks, computer crackers. Weak points in smart cities: traffic control systems, city management systems, mobile applications, public transportation, social media etc. Security related solutions for smart cities.

Topics for practical work.

1. Analysis of possibilities and development of proposals for the development of smart environment in the city of Chernihiv.
2. Development of proposals for the implementation of smart healthcare in the city of Chernihiv based on best practices.
3. Using best practices to develop smart industry and production in the city of Chernihiv.
4. Determining promising directions for the development of smart governance in the city of Chernihiv.
5. Nature-based solutions for the city of Chernihiv.
6. Development of recommendations for smart buildings in the city of Chernihiv.
7. Implementation of best practices in the development of smart transport in the city of Chernihiv.
8. Closing the adaptation knowledge gap: development of key points for the citizens of Chernihiv.

Topics for independent work.

1. Independent study of lecture material.
2. Preparation for practical work.
3. Preparation for the exam.
4. Completion of tasks on topics for independent work: The currently applied solutions in relation to the climate mitigation for transport sector in cities of Ukraine. Smart technologies implemented in buildings in Ukrainian cities. The currently applied solutions in relation to the climate mitigation for energy production in cities of Ukraine. The currently applied solutions

in Ukrainian cities for the climate mitigation for such urban development as consumption and lifestyle. Current state of the waste and water management systems in Ukrainian cities in the face of climate change. Technologies used for adaptation to climate change in cities of Ukraine.

8. Course evaluation system and requirements.

General course grading system	In the 2 nd semester, the completion of practical work (PW), current module control, and an exam are graded. In the 3 rd semester, grading for the project is provided.
Project requirements	The project must be prepared in accordance with the assignment. It must include all necessary elements reflecting the aim, objectives, planned results, etc. The presentation of the project must be accompanied by a presentation
Practical works	Each practical work is completed, defended and submitted to the examiner within the established deadlines in the form of a report, which must contain the topic of the work, the goal, brief theoretical information on the topic of the work, the practical part with the necessary graphs, drawings, tables, etc.
Requirements to be admitted to course completion	2 nd semester: completion of all required types of academic work (practical work, test) and at least 35 points scored during the semester for all types of work. 3 rd semester: completed project

Details on the points that master's students can receive

Module on the course content and control form		Number of points
2nd semester		
1	Completing tasks of practical work, preparing a report, timely defense of practical work	40 points (5 points * 8 PW)
2	Current module control	25 points
3	Completing tasks on independent work topics	10 points (5 points * 3 tasks)
Total for a current module control		75 points
Exam		25 points
Total		0...100
3rd semester		
1	Project	100 points
Total		0...100

Grading scale

Score in points	ECTS score	Grade on a national grading scale (differentiated credit)	
		for an exam (differentiated credit), term paper, practice, certification	for differentiated credit
90 – 100	A (<i>excellent</i>)	<i>excellent</i>	passed
82-89	B (<i>very well</i>)	<i>well</i>	
75-81	C (<i>well</i>)		
66-74	D (<i>satisfactory</i>)	<i>sufficient</i>	
60-65	E (<i>sufficient</i>)		

0-59	FX (insufficient)	<i>Insufficient with the possibility of retaking</i>	not passed with the possibility of retaking
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9. Equipment and Software.

Personal computer, Microsoft Office programs.

10. Course policy

Applicants for higher education who have completed all practical work and scored at least 35 points per semester for all types of work are admitted to the exam.

Deadline policy. Timely completion of the practical work report is graded at 1 point for each work. An exception may be the presence of valid reasons for late submission (illness, participation in other types of educational, scientific or organizational work at the specified time).

Rewards and academic penalty policy. Based on the results of educational, scientific or organizational activities of applicants for higher education, additional points may be awarded for the course – up to 10 points, depending on the significance of the achievements. Types of extracurricular activities for which applicants for higher education are rewarded with an additional number of points: participation in international projects, scientific research, articles, theses, participation in scientific and practical conferences.

Academic integrity policy. The copying of practical work reports, tests, and during the exam is not allowed. In case of copying, the applicant does not receive points for the copied practical or tests, exam and, as a result re-grading will be in accordance with the Code of Academic Integrity of the Chernihiv Polytechnic National University.

Credit transfer rules. The “Smart Cities and Climate Adaptation and Mitigation Strategies” course can be transferred if the applicant studied this course (or a similar course that forms the learning outcomes provided by the “Smart Cities and Climate Adaptation and Mitigation Strategies” course) in another educational institution. Also, individual practical work or course topics can be transferred if the applicant received the relevant competencies through information/informal education. Transfer is carried out in accordance with the “Procedure for determining the academic difference and transfer of academic disciplines at the Chernihiv Polytechnic National University”.

11. Recommended literature.

Basic

1. Acs Z. J. Innovation and the Growth of Cities. Cheltenham, Northampton : Edward Elgar, 2002. 247 p.
2. Gassmann O., Böhm J., Palmié M. Smart Cities: Introducing Digital Innovation to Cities. Bingley : Emerald Publishing, 2019. 368 p.
3. Haleboua G. R. Smart cities. Massachusetts : The MIT Press, 2020. 144 p.
4. Hall P., Tewdwr-Jones M. Urban and Regional Planning. Routledge. 6th Edition. New York : Routledge, 2020. 378 p.
5. Komninos N. Intelligent Cities and Globalisation of Innovation Networks. New York : Routledge, 2008. 307 p.
6. Landry C. Advanced Introduction to the Creative City. Cheltenham : Elgar Publisher, 2019. 192 p.

Additional

1. Bibri S. E. Smart sustainable cities of the future. Cham : Springer, 2018. 660 p.
2. Boulanger S. Smarter and Greener. A Technological Path for Urban Complexity. Milano : Francoangeli, 2020. 180 p.
2. Hall T., Barrett H. Urban geography. New York : Routledge, 2018. 394 p.
3. Sustainable Smart Cities Creating Spaces for Technological, Social and Business Development / M. Peris-Ortiz, D. R. Bennett, D. P. B. Yabar (Eds.). Springer, 2017. 238 p.
4. Urban Theory New critical perspectives / M. Jayneand, K. Ward (Eds.). New York : Routledge, 2016. 376 p.

Remote resources

1. The UniCities project : website. URL: <https://www.unicities.org.ua/en/general-info/>.

