SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Building Services Engineering
1.3	Department	Building Services Engineering
1.4	Field of study	Civil Engineering and Building Services
1.5	Cycle of study	Master
1.6	Program of study/Qualification	Building Services for Regenerative Cities / MS Engineer
1.7	Form of education	Full time

2. Data about the subject

2.1	Subject name	nZEB Buildings		Subject code	5.00
2.2	Course responsible/lecturer	Prof.PhD.Eng. Ligia Mihaela Moga: ligia.moga@ccm.utcluj.ro Assoc.Prof.PhD.Eng.Ancuţa Coca Abrudan: ancuta.abrudan@insta.utcluj.ro			
2.3	Teachers in charge of project	Prof.PhD.Eng. Ligia Mihaela Moga: ligia.moga@ccm.utcluj.ro Assoc.Prof.PhD.Eng.Ancuţa Abrudan: ancuta.abrudan@insta.utcluj.ro			

2.4 Year of study	I	2.5 Semester	I	2.6 Assessment	Exam
2.7 Subject category	Formative category				DS
	Optionality				DOB

3. Estimated total time

3.1 Number of hours per week	2	of which	3.2 Course	1	3.3 Seminar		3.3 Laboratory		3.3 Project	1
3.4 Total hours in the curriculum	28	of which	3.5 Course	14	3.6 Seminar		3.6 Laboratory		3.6 Project	14

3.7 Individual study:	
(a) Exams and tests	4
(b) Manual, lecture material and notes, bibliography	14
(c) **Supplementary study in the library, online and in the field**	14
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	10
(e) Tutoring	-
(f) Other activities	4

3.8 Total hours of individual study (sum (3.7(a)…3.7(f)))	47
3.9 Total hours per semester (3.4+3.8)	75
3.10 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1	Curriculum	Knowledge regarding building and HVAC design, Thermotechnics of Constructions, construction materials, bachelor's degree
4.2	Competence	Thermotechnics and HVAC calculation

5. Requirements (where appropriate)

5.1	For the course	Class attendance is not mandatory, but it will be a plus for the final grade. Photography and filming are prohibited during the course
5.2	For the applications Project	Class attendance is mandatory. Photography and filming are prohibited during tutorials.

6. Specific competences

Professional competences	CP3 - promote innovative infrastructure design CP14 - integrate measures in architectural designs CP23 - advise on construction materials CP28 - promote sustainable energy CP29 - develop energy saving concepts
Cross competences	CT1 - collaborating in teams and networks CT2 - thinks holistically CT3 - dealing with problems

7. Expected Learning Outcomes

Knowledge	CP3 - Knows current trends in sustainable urban design (nZEB, green infrastructure), innovative technologies (IoT sensors, smart grids, advanced materials), and concepts of urban resilience and circular economy. CP 14 - Has in-depth knowledge of specific fire protection, acoustic protection, building physics measures, and methods for integrating installations into complex architectural projects, including requirements for green and regenerative buildings. CP 23 - Has in-depth knowledge of construction materials used in urban infrastructure (pipelines, structures, finishes, sustainable and recycled materials), technical properties, durability, environmental impact, and quality standards. CP28 - Has in-depth knowledge of renewable energy-based technologies (solar thermal, photovoltaic, wind, biomass, geothermal, hydrogen), specific regulations, support and funding schemes, circular economy principles, and their integration into urban infrastructure. CP29 - Has in-depth knowledge of energy management systems (BMS), monitoring and control technologies, energy performance indicators (EnPI), consumption reduction strategies (demand response, load shifting, energy efficiency), and building energy certification principles.

Skills	CP 3 - Identifies and evaluates innovation opportunities in urban infrastructure projects, integrates new technologies and unconventional solutions (rainwater harvesting systems, smart pipes, multifunctional infrastructure), develops innovative project proposals, and actively promotes sustainable approaches in professional settings and before authorities. CP 14 - Incorporates fire safety, acoustic protection, energy efficiency, and water management measures into architectural projects, respecting specific requirements and coordinating with architects for harmonious and functional integration, using BIM tools and integrated methodologies. CP23 - Analyzes technical and environmental requirements for urban infrastructure projects, evaluates material alternatives from technical, economic, and sustainability perspectives, provides well-reasoned recommendations for optimal material selection, develops technical specifications and best practice guidelines. CP28 - Analyzes the potential of renewable sources for various urban applications, evaluates technical and economic solutions, develops feasibility studies and cost-benefit analyses, develops promotion and training materials, provides consulting for implementation and funding access. CP29 - Develops integrated concepts for saving energy resources in smart buildings, designs consumption optimization strategies (lighting, HVAC, appliances), integrates renewable sources and storage systems, evaluates energy performance through simulations and monitoring.
Responsibilities and autonomy	CP3 - Initiates and promotes innovative solutions for urban infrastructure, assuming calculated risks in the context of sustainable development, convincingly argues benefits before decision-makers, and contributes to paradigm shifts in regenerative urban planning. CP14 - Coordinates the integration of special measures into architectural projects, ensuring regulatory compliance and technical performance, assuming responsibility for user safety, comfort, and indoor environmental quality, in line with regenerative urban development principles. CP23 - Acts as an expert in material selection for urban infrastructure, providing high-level consulting and assuming responsibility for the performance, durability, and environmental impact of recommended materials, in the context of circular economy and regenerative urban development. CP28 - Actively and responsibly promotes renewable energy-based solutions, assuming responsibility for the technical and economic foundation of recommendations and for contributing to decarbonization and sustainability goals in the urban environment. CP29 - Leads the development of energy resource saving concepts for smart buildings, assuming responsibility for energy performance, for integrating innovative solutions, and for compliance with sustainability standards.

8. Discipline objectives (as results from the *key competences gained*)

8.1	General objective	Developing skills for designing high nearly Zero Energy Buildings Synthesizing, explaining and transmitting information for nearly Zero Energy Buildings
8.2	Specific objectives	Acquiring knowledge regarding legislation and design norms nZEBs Skills development in designing nZEBs To know in detail the role of building services components and systems in designing nZEBs. Using the latest scientific and technical achievements (national and international) trends for developing design nZEBs

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Overview, objectives, history. Energy efficiency at buildings. Legislation and norms regarding thermal	2	Exposure, applications	Video-projector

performance of new buildings and thermal rehabilitation process at existing buildings			
2. nZEBs definition. Principles and design criteria.	2		
3. Constructive solutions for nZEBs. Types of energy efficient windows.	2		
4. Evaluation methodologies for the energy performance of a building and building services.	2		
5. Use of cogeneration for nZEBs	2		
6. Use of renewable energy for buildings: wind power and geothermal energy	2		
7. Use of renewable energy for buildings: solar energy and heat pumps	2		

Bibliography

1. Horia-A. Andreica, Munteanu C., Moga L. Et al, *Construcţii Civile*, UTPRESS, 2009
2. Moga L., Optimizarea termoenergetică a elementelor vitrate, U.T.Press, 2013, ISBN 978-973-662-793-4
3. Popescu Razvan, Stefan: Utilizarea energiei regenerabile in cladiri, Editura MATRIX ROM, 2019, ISBN: 978-606-25-0290-4
4. Manualul de Instalatii – Instalatii de incalzire, Editura MATRIX ROM, 2010
5. *** Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings
6. *** Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.
7. Hendriks L.; Hens H. Building Envelopes in a Holistic Perspective, ISBN-10-9075741057, 2010.
8. *** http://www.passivhaus.de/
9. *** www.usgbc.org/leed
10. *** http://www.breeam.com/
11. *** http://isb.pub.ro/docs/Energii_regenerabile.pdf /
12 *** https://www.mlpda.ro/userfiles/metodologie_calcul_performanta_energetica_iulie2014.pdf

9.2. Project	Number of hours	Teaching methods	Notes
1. Presentation of the project theme. Identification of required building layouts.	2	Exposure, applications	Standards and Norms, AutoCad, AllPlan, MathCad, energy modelling and design tools
2. Identification of building's envelope components. Constructive detailing design specific for nZEBs.	2		
3. Evaluation of the thermal performance of the building envelope components	2		
4.Evaluation of the global insulation coefficient of the building envelope.	1		
5. Presentation of the project theme. Description of all possible renewable energy types to be used in nZEBs.	3		
6. Calculation method using heat pumps	2		
7. Calculation method using wind power	2		

Bibliography
1. Moga Ligia, Moga Ioan Punţi termice specifice clădirilor cu pereţi structurali din zidărie, Ed. U.T. Press, Cluj-Napoca, 2013, pp. 138, ISBN 978-973-662-799-6.
2. Moga Ligia, Moga Ioan, "Punţi termice specifice planşeelor terasă, de pod, deasupra subsolului şi plăcilor pe sol la clădiri cu pereţi din zidărie", Ed. U.T. Press, Cluj-Napoca, 2017, pp. 164, ISBN 978-606-737-245-8.
3. Moga L., Rusu A., Performanţa termică a clădirilor din panouri mari prefabricate: îndrumător de calcul, U.T.Press, 2013
4. *** Thermotechnics design norms C107/0...7-2005
5. Manualul de Instalatii – Instalatii de incalzire, Editura MATRIX ROM, 2010

Software:
1. AutoCAD, Student Version
2. Allplan Inginerie, Student Version
3. Mathcad

Specialized software for the calculation of the equipment specified in the theme

10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

The gained knowledge will be necessary for employees that will work in building design field and building services systems. This satisfies employers' requirements.

11. Evaluation

Activity type	11.1 Assessment criteria	11.2 Assessment methods (and evaluation form: continuous/summative)	11.3 Weight in the final grade
11.4 Course	20 theoretic questions	Written test of 2.0 h - on-site or 30 min online	30%
11.5 Project	Evaluation of written part, calculations and drawings	Project presentation for 40 min	70%
11.6 Minimum standard of performance			
Exam grade E≥5; Project/paper grade A≥5 **E= [0.3 (T) +0.7 (P)]** The final grade will take into consideration the student's involvement during the semester			

Date of filling in:		Title Surname Name	Signature
16.05.2026	Lecturer	Prof.PhD.Eng. Ligia Mihaela Moga Assoc.Prof.PhD.Eng. Ancuţa Abrudan	
	Teachers in charge of application	Prof.PhD.Eng. Ligia Mihaela Moga	
		Assoc.Prof.PhD.Eng.Ancuţa Abrudan	

Date of approval in the Department of Building Services Engineering 09.07.2026	Head of department Assoc.Prof.PhD.Eng. Ciprian BACOŢIU
Date of approval in the Council of the Faculty of Building Services Engineering 09.07.2026	Dean Assoc.Prof.PhD.Eng. Florin DOMNIŢA