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			Energy Analysis of a Building/City	Subject code	11.00	
2.2	Course responsible/lecturer			PhD. Eng. Ancuța Maria MĂGUREAN – ancuta.magurean@termo.utcluj.ro; ancuta.magurean@ecoverproiect.com			
2.3	Teachers in charge of laboratory			PhD. Eng. Ancuța Maria MĂGUREAN – ancuta.magurean@termo.utcluj.ro; ancuta.magurean@ecoverproiect.com			
2.4 Year of study	1	2.5 Semester	2	2.6 Assessment		Exam	
2.7 Subject category	Formative category					DC	
	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	1	3.3 Project		
3.4 Total hours in the curriculum	28	of which	3.5 Course	14	3.6 Seminar		3.6 Laboratory	14	3.6 Project		
3.7 Individual study:											
(a) Exams and tests										3	
(b) Manual, lecture material and notes, bibliography										10	
(c) Supplementary study in the library, online and in the field										10	
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										18	
(e) Tutoring										-	
(f) Other activities										6	
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	General knowledge related to civil engineering, building services, thermo-technics, electrotechnics, energy and renewable energy sources.
4.2	Competence	Technical competences in the field of architecture and civil engineering, building services, or mechanical engineering

5. Requirements (where appropriate)

5.1	For the course	Classroom equipped with blackboard and Video Projector - 21 December 1989 Blvd., no. 128-130
5.2	For the applications Laboratory	Classroom equipped with blackboard and Video Projector - 21 December 1989 Blvd., no. 128-130

6. Specific competences

Professional competences	CP2 – synthesize multiple data and information CP4 – promotes awareness of environmental issues CP6 – assess the environmental impact CP12 – uses measuring instruments CP14 – integrates measures into architectural projects CP21 – combines multiple areas of knowledge CP24 – uses CAD software CP28 – promotes the use of energy from renewable sources CP29 – develops concepts for saving energy resources
Cross competences	CT2 – thinks holistically CT3 – solve problems

7. Expected Learning Outcomes

Knowledge	CP2 – Knows methods of critical analysis of information sources specific to the buildings as major energy consumers in urban environments, synthesis techniques CP4 – Has in depth knowledge on the anthropogenic impact on the environment (carbon footprint and resource consumption) of the buildings, environmental regulation (European directives, national legislation) CP6 – Has in depth knowledge of environmental impact assessment methodology for buildings (CO_2 emission calculation) – Mc001/2022, and the ability to calculate energy consumptions and carbon emission in buildings for different facilities and energy production with renewable sources CP12 – Knows measurement instruments (infrared thermography) used in the quality assessment and diagnose of building's envelope and equipment, operating principles, and calibration procedures. CP14 – Has relevant knowledge for different solutions integration in buildings to reduce energy consumption and to decarbonize energy sources (e.g., building physics measures, HVAC, DHW and lighting technologies), including requirements for green and regenerative buildings CP21 – Possesses integrated knowledge from diverse fields (energetics, mechanical engineering, building services engineering, architecture & civil engineering, urban planning, environmental sciences, public policy), essential for a holistic approach to regenerative cities through decarbonized buildings CP24 – Has in depth knowledge of CAD software, including representation standards CP28 – Has relevant knowledge of renewable energy-based technologies, and their controlled integration into buildings in order to reach national targets (e.g., nZEB / ZEB) CP29 – Has in depth knowledge of energy performance indicators (EnPI), consumption reduction strategies, energy management systems (BMS), and building energy certification principles

Skills	CP2 – Critically analyzes technical projects, impact studies, and geo-spatial data and existent buildings, selects relevant information as input data for energy audits and/or nZEB compliances reports CP4 – Provides consulting on reducing environmental impact and promoting sustainable solutions for new and existent buildings CP6 – Evaluates the environmental impact of operation of buildings, proposes mitigation measures with measurable targets to be achieved CP12 – Correctly uses of infrared thermography camera, interprets measured values and distribution of temperatures on surfaces, records data CP14 – Incorporates energy efficiency measures into architectural projects, respecting specific requirements (e.g., fire safety norms or other design norms) and coordinating with architects for functional integration, using integrated energy efficiency assessment and design methodology, Mc001/2022 CP21 – Integrates perspectives from multiple disciplines in the analysis and solution of complex urban problems such as decarbonization of buildings, collaborates effectively with specialists from different fields, and develops interdisciplinary solutions that simultaneously address technical, social, economic, and environmental requirements CP24 – Uses CAD/BIM software for the building's technical project analysis and measurements (layout plans, cross sections, HVAC blueprints) to provide energy performance assessment of the building and its HVAC, DHW and lighting equipments CP28 – Analyzes the potential of renewable sources for various urban applications (e.g., to supply buildings), evaluates technical and economic solutions, provides consulting for implementation and funding access CP29 – Develops integrated concepts for saving energy resources in smart buildings, designs consumption optimization strategies (HVAC, DHW, lighting), integrates renewable sources and storage systems, evaluates energy performance through simulations
Responsibilities and autonomy	CP2 – Independently evaluates information sources, forms technical-based opinions, assuming responsibility for the validity of energy analyses in buildings CP4 – Acts as a sustainability promoter in the design and construction of new buildings and renovation of existent buildings, promoting best practices for nearly Zero Energy Building and deep renovation of existent buildings CP6 – Approaches environmental impact assessment processes for buildings (calculation of CO_2 emissions associated with the normal operation of buildings), for compliance with national and European regulations CP12 – Performs measurements responsibly for building air leakage and equipment defects identification, verifies instrument calibration and reports any deviation CP14 – Provides consultancy for integration of targeted energy efficiency measures into architectural projects, ensuring regulatory compliance and technical performance pursued CP21 – Addresses the challenges of regenerative urban development from a holistic and integrated perspective of buildings decarbonization, in collaboration with all stakeholders CP24 – Uses advanced CAD tools in coordination with other specialties, and compliance with standards 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 urban environment, in particular in buildings CP29 – Contributes to the development of energy resource saving concepts for smart and energy efficient buildings, assuming responsibility for energy performance, for integrating innovative solutions, and for compliance with energy efficiency or sustainability standards

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

8.1	General objective	Knowledge transfer based on computational methodological framework and case study-based experiences regarding energy consumption assessment and management in buildings, as major energy consumer in (non) regenerative cities, so as to empower the participants to act as local Energy Auditors. Prepare participants with skills similar to those of certified Building Energy Auditors and certified Energy Managers.
8.2	Specific objectives	Integrative knowledge of the energy assessment in buildings, local energy generation and use in the regenerative cities. Knowledge of the legislation and authorities involved in the energy analysis in buildings and management in local communities, respectively of the role of energy audit and of energy management for local communities. The ability to effectively develop and use energy assessment tools, and to propose and assess the impact of different energy efficiency solutions, both for construction and for its systems, with target criteria and thresholds to be achieved. Financing, energy performance contracting.

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Course 1. Legislation and technical regulations regarding the energy analysis of the buildings. Notions of final energy, primary energy and CO_2 emissions	2	Discussions based on materials provided in advance. Question and answer sessions. Presentations of case studies and examples. Use of online tools for direct interaction, use of powerpoint materials and writing ideas and calculation models on the board. Presentation of energy analytics calculation models.	
Course 2. Analysis and calculation of energy need and consumption for heating in buildings	2		
Course 3. Analysis and calculation of energy need consumption for domestic hot water in buildings	2		
Course 4. Analysis and calculation of energy production / consumption in buildings provided by solar thermal systems	2		
Course 5. Site surveys in energy evaluation of buildings for deep renovation purposes – procedures, steps, instrumentation, case studies and examples	2		
Course 6. Technologies and solutions for energy efficient buildings – holistic approach	2		
Course 7. The Energy Audit Report and the nZEB Compliance Report	2		

Bibliography

1. MC001-2022 METODOLOGIE DE CALCUL AL PERFORMANȚEI ENERGETICE A CLĂDIRILOR
2. Energy performance of buildings. Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads. Part 1: Calculation procedures
3. SR EN 15316–1. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4
4. SR EN 15316–2. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5
5. SR EN 15316–3. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 3: Distribution systems (domestic hot water, heating and cooling), Modules M3-6, M4-6, M8-6
6. SR EN 15316–4-1. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-1: Heat production systems for heating and preparation of domestic hot water: combustion plants (boilers, biomass), Modules M3-8-1, M8-8-1
7. SR EN 15316–4-2. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2
8. SR EN 15316–4-3. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-3: Heat generation systems, thermal solar and photovoltaic systems, Module M3-8-3, M8-8-3, M11-8-3
9. ANALIZA PERFORMANȚEI ENERGETICE A CLĂDIRILOR NEREZIDENȚIALE PRIN TEHNICI DE MODELARE NUMERICĂ ȘI INTELIGENȚĂ ARTIFICIALĂ APLICATĂ", Măgurean A.M.,Teză de doctorat, Editura UTPress, Cluj-Napoca, 2021

9.2. Laboratory	Number of hours	Teaching methods	Notes
1. Analyses and energy calculations within the Analysis and certification report. The energetic analysis sheet	2	Use of online tools for direct interaction, use of powerpoint materials and writing on the board ideas and calculation models. Presentation of energy analytics calculation models.	
2. Calculation of energy demand and consumption for heating	4		
3. Calculation of the energy demand and consumption for preparing Domestic Hot Water	2		
4. Solar thermal systems	2		
5. Site survey tools to identify air leaks in buildings and equipment/pipeline defects	2		
6. Results integration in the project, using all the previous tools and laboratory applications	2		

Bibliography

1. MC001-2022 METODOLOGIE DE CALCUL AL PERFORMANȚEI ENERGETICE A CLĂDIRILOR
2. Energy performance of buildings. Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads. Part 1: Calculation procedures
3. SR EN 15316–1. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 1: General and Energy performance expression, Module M3-1, M3-4, M3-9, M8-1, M8-4
4. SR EN 15316–2. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 2: Space emission systems (heating and cooling), Module M3-5, M4-5

5. SR EN 15316–3. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 3: Distribution systems (domestic hot water, heating and cooling), Modules M3-6, M4-6, M8-6 6. SR EN 15316–4-1. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-1: Heat production systems for heating and preparation of domestic hot water: combustion plants (boilers, biomass), Modules M3-8-1, M8-8-1 7. SR EN 15316–4-2. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-2: Space heating generation systems, heat pump systems, Module M3-8-2, M8-8-2 8. SR EN 15316–4-3. Energy performance of buildings. Method for calculation of system energy requirements and system efficiencies. Part 4-3: Heat generation systems, thermal solar and photovoltaic systems, Module M3-8-3, M8-8-3, M11-8-3

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

The preparation and periodical update of the course will take into account the existent curricula at international level, the consultation of relevant professional associations and authorities, the legal frame evolution and national and international implemented projects in energy, energy efficiency and energy audit in buildings and management in local communities.

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	The exam consists in verifying the theoretical and practical knowledge acquired	Oral examination	25%
11.5 Laboratory	Project based on laboratories integration evaluation	Team presentation of the achieved projects	75%
11.6 Minimum standard of performance			
Participation in the laboratory conditions the entrance to the exam. Exam grade components (E); Laboratory (L); Calculation formula of the grade G = 0.25 × E + 0.75 × L Condition for obtaining credits: G> 5.0; where E> 5.0, L> 5.0			

Date of filling in:		**Title Surname Name**	**Signature**
02.06.2026	Lecturer	PhD. Eng. Ancuța Maria MĂGUREAN	
	Teachers in charge of application	PhD. Eng. Ancuța Maria MĂGUREAN	

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