

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	Dissertation Project Work	Subject code	23.00
2.2	Course responsible/lecturer	-		
2.3	Teachers in charge	Scientific advisor		
2.4	Year of study	II	2.5 Semester	II
			2.6 Assessment	Verification
2.7	Subject category	Formative category		
		Optional		
				DS
				DOB

3. Estimated total time

3.1 Number of hours per week	7	of which	3.2 Course		3.3 Seminar		3.3 Laboratory		3.3 Project	7
3.4 Total hours in the curriculum	98	of which	3.5 Course		3.6 Seminar		3.6 Laboratory		3.6 Project	98
3.7 Individual study:										
(a) Exams and tests										2
(b) Manual, lecture material and notes, bibliography										40
(c) Supplementary study in the library, online and in the field										40
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										70
(e) Tutoring										-
(f) Other activities										-
3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))					152					
3.9 Total hours per semester (3.4+3.8)					250					
3.10 Number of credit points					10					

4. Pre-requisites (where appropriate)

4.1	Curriculum	Bachelor's degree in one of the following fields: - building services engineering; - civil engineering; - architecture; - other related specializations.
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	
5.2	For the development of professional practice	

6. Specific competences

Professional competences	CP1 – perform project management CP2 – synthesizes information CP3 – promote innovative infrastructure design CP5 – execute feasibility study CP6 – assess environmental impact CP12 – use measurement instruments CP16 – measure parts of manufactured products CP20 – mitigate environmental impact of pipeline projects CP21 – combine multiple fields of knowledge CP22 – detect flaws in pipeline infrastructure CP24 – use CAD software CP28 – promote sustainable energy CP29 – develop energy saving concepts
Cross competences	CT1 – collaborating in teams and networks CT2 – thinks holistically CT3 – dealing with problems CT4 – respects the diversity of values and cultural norms

7. Expected Learning Outcomes

Knowledge	CP1 – Knows project management methodologies applicable to urban infrastructure, planning tools, resource allocation techniques, and cost control specific to pipeline and urban network projects. CP2 – Knows methods of critical analysis of information sources specific to the urban domain (environmental studies, infrastructure reports, European regulations), synthesis techniques, and how to structure complex data to support decision-making in urban planning. 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. CP5 – Has in-depth knowledge of feasibility study methodology for urban infrastructure projects, financial and social performance indicators, multi-criteria evaluation criteria, and legal, environmental, and social aspects specific to the urban context. CP6 – Has in-depth knowledge of environmental impact assessment methodologies for urban infrastructure projects, urban sustainability indicators (ecological footprint, air quality, urban biodiversity), and sustainable development principles in the context of regenerative cities. CP12 – Knows measurement instruments used in urban infrastructure monitoring (flow meters, pressure sensors, water quality probes), operating principles, and calibration procedures. CP16 – Knows measurement instruments used in manufacturing and quality control of pipeline and installation components (calipers, micrometers, wall thickness gauges, hydrostatic testing equipment), tolerances, and technical specifications. CP20 – Knows methods for assessing and mitigating the environmental impact of pipeline projects (soil protection, waste management, biodiversity protection, emission reduction), environmental regulations, and technical solutions for impact reduction. CP21 – Possesses integrated knowledge from diverse fields (building services engineering, architecture, urban planning, environmental sciences, circular economy, public policies, urban sociology), essential for the holistic approach to regenerative cities. CP22 – Knows urban pipeline failure modes (corrosion, cracks, assembly errors, settling, leaks), detection methods (visual inspection, video cameras, acoustic sensors, pressure tests), and integrity assessment procedures. CP24 – Has in-depth knowledge of CAD and BIM software used in urban infrastructure design (Revit), advanced functionalities (3D modeling), and representation 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.
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Skills

CP1 – Develops project plans for urban infrastructure, defines stages and deliverables, allocates human and material resources, monitors progress through performance indicators, manages relationships with stakeholders (authorities, developers, communities), and periodically reports project status.

CP2 – Critically analyzes technical reports, impact studies, and geo-spatial data, selects relevant information for urban infrastructure projects, synthesizes and structures knowledge coherently, producing documented summaries for project teams and authorities.

CP3 – 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.

CP5 – Collects and analyzes technical, economic, social, and environmental data for urban infrastructure projects, develops alternative scenarios (technologies, routes, sustainable solutions), calculates performance indicators, evaluates risks and uncertainties, formulates well-founded recommendations, and drafts the study according to beneficiary and funder requirements.

CP6 – Monitors and evaluates the environmental impact of urban infrastructure projects (water, sewage, transport networks), identifies environmental and social risks, develops impact assessment studies, proposes mitigation, compensation, and monitoring measures, integrates circular economy and climate resilience principles into proposed solutions.

CP12 – Selects the appropriate instrument for required measurements (flow rates, pressures, water quality, spatial positioning), correctly uses it in field conditions, interprets measured values, and records data in urban monitoring systems.

CP16 – Correctly uses measurement instruments to verify pipeline and installation components, records values and compares with technical specifications, identifies deviations and proposes adjustments, completes quality control documents.

CP20 – Analyzes the environmental effects of pipeline projects, develops impact management plans, proposes mitigation measures (low-impact technologies, restoration of affected areas, monitoring), collaborates with environmental authorities and the community to implement measures.

CP21 – Integrates perspectives from multiple disciplines in analyzing and solving complex urban problems, collaborates effectively with specialists from different fields (architects, urban planners, ecologists, sociologists, economists), develops interdisciplinary solutions that simultaneously address technical, social, economic, and environmental requirements.

CP22 – Uses visual and instrumental methods to identify defects in urban pipeline networks, locates critical points, estimates causes and severity of defects, prioritizes interventions, and develops diagnostic reports for maintenance teams.

CP24 – Uses CAD/BIM software for designing urban pipeline networks, creates integrated 3D models, develops layout plans, longitudinal profiles, and cross-sections, coordinates projects with other utilities, extracts material and quantity lists, collaborates in common data environments (CDE).

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	CP1 – Leads complex urban infrastructure and pipeline system projects autonomously, makes managerial decisions in the specific context of the urban environment, coordinates interdisciplinary teams, and is directly responsible for achieving objectives within established deadlines and budgets, in compliance with local and European regulations. CP2 – Independently evaluates information sources, forms evidence-based opinions, supports conclusions before public authorities and stakeholders, assuming responsibility for the validity of analyses in the context of regenerative urban development. 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. CP5 – Coordinates interdisciplinary teams for developing feasibility studies for complex urban infrastructure projects, assuming responsibility for the quality, objectivity, and scientific foundation of analyses and for recommendations that influence the sustainable development of communities. CP6 – Coordinates environmental impact assessment processes for complex urban infrastructure projects, assuming responsibility for the quality of analyses, for compliance with national and European regulations, and for integrating environmental protection measures into technical solutions that shape sustainable urban development. CP12 – Performs measurements responsibly in the urban environment, verifies instrument calibration and reports any deviations, assuming responsibility for data accuracy that underpins operation and maintenance decisions for infrastructure. CP16 – Performs measurements with precision and rigor, aware of the impact of tolerances on the quality and durability of pipeline systems, assuming responsibility for the conformity of components used in urban infrastructure. CP20 – Manages environmental impact mitigation processes for complex pipeline projects, assuming responsibility for environmental protection, regulatory compliance, and community dialogue, in the context of sustainable urban development. CP21 – Approaches regenerative urban development challenges from a holistic and integrated perspective, assuming responsibility for solutions that harmonize the multiple dimensions of sustainability, in collaboration with all stakeholders and respecting cultural and social diversity. CP22 – Performs systematic inspections of urban pipeline infrastructure, records findings, and promptly reports situations requiring urgent intervention, assuming responsibility for maintaining safety and continuity of community services. CP24 – Executes complex urban infrastructure projects using advanced CAD/BIM tools, assuming responsibility for model accuracy, coordination with other specialties, and compliance with standards and beneficiary requirements. 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.
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8. Discipline objectives (as results from the *key competences gained*)

8.1	General objective	Development of students' ability to elaborate a dissertation that integrates the knowledge and skills acquired during the master's program, demonstrates the capacity for applied scientific research in the field of building services for regenerative cities, and presents innovative, sustainable, and well-founded solutions to the complex problems of urban infrastructure.
8.2	Specific objectives	• Development of the ability to plan and manage a complex research project, from defining objectives and methodology

		to formulating conclusions and recommendations (CP1, CP2, CP5, CP21). • Development of skills to critically analyze bibliographic sources, synthesize complex information, and identify the current state of knowledge in the chosen topic area (CP2, CP21). • Development of competencies in modeling, simulation, and technical analysis using specialized software (CP12, CP16, CP22, CP24). • Development of the ability to assess the environmental impact of proposed solutions and to propose mitigation measures, in line with circular economy and sustainable development principles (CP6, CP20). • Development of skills to integrate renewable energy sources and energy saving concepts into proposed technical solutions (CP28, CP29). • Consolidation of holistic and interdisciplinary thinking in addressing complex urban problems, integrating technical, social, economic, and environmental aspects (CP21, CT2, CT3). • Development of the ability to work autonomously, make responsible decisions, and take ownership of the conclusions and recommendations formulated in the dissertation, in collaboration with the supervisor and respecting academic standards and diversity of opinions (CT1, CT4).
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9. Contents

9.1. Theme area	Number of hours	Teaching methods	Notes
Advanced building services - HVAC and water distribution			
nZeB Buildings			
Buildings and cities assessment			
Energy analysis of a building / city			
Urban network management			
Life cycle analysis			
Building services retrofit solutions			
Use of renewable energy sources			
Urban electrical infrastructure			
9.2. Applications	Number of hours	Teaching methods	Notes
Presentation of the topic of professional practice	4	Exposure, applications	
The state of knowledge at national and international level	12		
Calculation methodology used nationally and internationally	12		
Case study based on the calculation methodology used	18		
Own contributions	10		
Final conclusions	10		
Elaboration of the dissertation paper in final form	30		
Deliver and present the elaborated project	2		

Bibliography

1. Course notes related to the disciplines studied in the first, second and third semesters of the master's cycle.
2. Bibliographic sources specific to the project / practice topic.
3. Online and electronic documentation sources;
4. Legislation specific to each topic.

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 services engineering design, execution, project management and energy assessment of buildings / cities.

11. Evaluation

Activity type	11.1 Assessment criteria	11.2 Assessment methods	11.3 Weight in the final grade
11.4 Course	-		
11.5 Applications	Knowledge of the current stage of the topic (note A); Evaluation of the practical results obtained (note B); Personal contributions to the dissertation (note B); Presentation of the practice report (note C); Supporting the practice report (note D).	Presentation of the dissertation thesis	50% dissertation thesis 50% presentation
11.6 Minimum standard of performance			
Grade components:			
$G = 0.2 \cdot A + 0.4 \cdot B + 0.2 \cdot C + 0.2 \cdot D$;			
Condition for obtaining credits: $G > 7$; $A > 5$; $B > 5$; $C > 5$; $D > 5$.			

Date of filling in:		Title Surname Name	Signature
10.05.2026	Lecturer		
	Teachers in charge of application	Lect.PhD. Eng Constantin CILIBIU	
Date of approval in the Department of Building Services Engineering		Head of department	
09.07.2026		Assoc.Prof.PhD.Eng. Ciprian BACOȚIU	
Date of approval in the Council of the Faculty of Building Services Engineering		Dean	
09.07.2026		Assoc.Prof.PhD.Eng. Florin DOMNIȚA	

