

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				Control Systems for Smart Homes and Cities	Subject code	19.20
2.2	Course responsible/lecturer				Assoc. Prof. PhD Eng. Calin Ciugudeanu,		
2.3	Teachers in charge of seminars				Assoc. Prof. PhD Eng. Calin Ciugudeanu, Calin.ciugudeanu@insta.utcluj.ro		
2.4	Year of study	II	2.5	Semester	1	2.6 Assessment	Colloquy
2.8 Subject category		Formative category					DS
		Optional					DOP

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										15
(c) Supplementary study in the library, online and in the field										15
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										12
(e) Tutoring										2
(f) Other activities										-
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	Physics and Electrotechnical elements
4.2	Competence	Electronic engineering, Use of computer (MS-Office; Autocad)

5. Requirements (where appropriate)

5.1	For the course	Classroom equipped with Video Projector - 21 December 1989 Blvd., no. 205.
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5.2	For the laboratory	Classroom equipped with Video Projector - 21 December 1989 Blvd., no. 108, 109.
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6. Specific competences

Professional competences	CP3 – promote innovative infrastructure design; CP14 – integrate measures in architectural designs; CP21 – combine multiple fields of knowledge; CP29 – develop energy saving concepts.
Cross competences	CT1 – collaborating in teams and networks; CT3 – dealing with problems.

7. Expected Learning Outcomes

Knowledge	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. 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. 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. 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	Identifies and evaluates innovation opportunities in urban infrastructure projects, integrates new technologies and unconventional solutions, develops innovative project proposals, and actively promotes sustainable approaches in professional settings and before authorities. 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. Integrates perspectives from multiple disciplines in analyzing and solving complex urban problems, collaborates effectively with specialists from different fields, and develops interdisciplinary solutions that simultaneously address technical, social, economic, and environmental requirements. 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	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. 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. 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. 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	Acquiring competences in smart control systems
8.2	Specific objectives	• Overview of energy control systems in various infrastructures like street lighting or built environments • Knowledge of EU Directive 2018/844 of the Energy Performance of Buildings, Directive (2010/31/EU) - measures to establish an optional scheme for rating the smart readiness of buildings. • Finding the optimal control systems for smart homes and cities • The course also includes a project in which students must study an energy system of their own interest, from a systems and controls perspective.

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Introduction: Concept and classification of control system	2	Video-Projector Teaching style based on the interactive teacher-student partnership; Presentation of case studies.	
2. Conventional Control Systems and Home Automation Control Systems	2		
3. Smart Control Centre	2		
4. Home Security Control Systems	2		
5. Smart lighting Management	2		
6. Room Climate Control Systems	2		
7. Shading Control Systems	2		
Bibliography			
1. N C Jagan, “Control Systems”, BS Publications, 1st Edition, 2007.			
2. A Anand Kumar, “Control Systems”, PHI Learning, 1st Edition, 2007.			
3. Schneider Electric, Manualul instalațiilor electrice, 2007;			
4. https://www.se.com/ro/ro/work/products/building-automation-and-control/			
5. https://www.researchgate.net/			
6. https://www.electrical4u.com/			

9.2. Laboratory	Number of hours	Teaching methods	Notes
1. Understanding the Control Systems for Smart Homes	2	Modeling execution, computer exercises, group project	
2. Proposing a Smart Home Control System Concept - groups of four students	2		
3. Detailed Design and Utilisation Instructions	4		
4. Smart Readiness Indicator – SRI calculation	2		
5. Concept Presentation	4		
Bibliography			
1. G. M. Masters, Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2013. 2. D. Callaway and I. Hiskens, "Achieving controllability of electric loads," Proceedings of the IEEE, vol. 99, no. 1, pp. 184 –199, jan. 2011. 3. Schneider Electric, Manualul instalațiilor electrice, 2007; 4. https://www.se.com/ro/ro/work/products/building-automation-and-control/ 5. DialuxEvo software free downmload at www.dial.de			

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

The competences achieved are necessary in the field of electrical design of the future urban electrical infrastructures. The demands of the energetic employees are being satisfied.

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	Technical content, word count, structure and critical analysis;	Final report grade	60%
11.5 Laboratory	Technical content, presentation and communication skills;	class activity, assignments, presentation grade	40%
11.6 Minimum standard of performance			
5 points out of 10 total points (5 min/10 max)			

Date of filling in:		Title Surname Name	Signature
12.05.2026	Lecturer	Assoc. Prof. PhD Eng. Calin Ciugudeanu	
	Teachers in charge of application	Assoc. Prof. PhD Eng. Calin Ciugudeanu	

Date of approval in the Department of Building Services
Engineering

09.07.2026

Head of department
Assoc.Prof.PhD.Eng. Ciprian BACOȚIU

Date of approval in the Council of the Faculty of Building
Services Engineering

09.07.2026

Dean
Assoc.Prof.PhD.Eng. Florin DOMNIȚA