

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				Building Services Retrofit Solutions		Subject code	10.00
2.2	Course responsible/lecturer				Assoc.Prof.PhD.Eng. <i>Octavian Pop</i> – <i>octavian.pop@insta.utcluj.ro</i>			
2.3	Teachers in charge of project				Assoc.Prof.PhD.Eng. <i>Octavian Pop</i> – <i>octavian.pop@insta.utcluj.ro</i>			
2.4	Year of study	I	2.5	Semester	II	2.6 Assessment		E
2.7 Subject category		Formative category						DS
		Optionality						DOB

3. Estimated total time

3.1 Number of hours per week	3	of which	3.2 Course	1	3.3 Seminar		3.3 Laboratory		3.3 Project	2
3.4 Total hours in the curriculum	42	of which	3.5 Course	14	3.6 Seminar		3.6 Laboratory		3.6 Project	28
3.7 Individual study:										
(a) Exams and tests										2
(b) Manual, lecture material and notes, bibliography										25
(c) Supplementary study in the library, online and in the field										9
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										20
(e) Tutoring										2
(f) Other activities										-
3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))					58					
3.9 Total hours per semester (3.4+3.8)					100					
3.10 Number of credit points					4					

4. Pre-requisites (where appropriate)

4.1	Curriculum	
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	Amphitheatre, B-dul 21 Decembrie Nr.128-130, Cluj-Napoca
5.2	For the applications Laboratory	Laboratory room, B-dul 21 Decembrie Nr.128-130, Cluj-Napoca

6. Specific competences

Professional competences	CP24 – use of CAD software CP25 – manage air quality CP28 – promote sustainability energy CP29 – develop energy savings concepts
Cross competences	CT2 – thinks holistically CT3 – dealing with problems

7. Expected Learning Outcomes

Knowledge	CP24 – the discipline relies on CAD software use in order to analyse building architecture for potential implementation of retrofit scenarios and drawing/schematic representation of retrofit schemes that include modern energy efficient technologies. CP25 – building retrofit scenarios depend heavily on required indoor air quality, therefore, the assessed technology must be capable to provide adequate indoor conditions, considering all the energy savings possibilities. CP28 – knowledge regarding the use of renewable energy sources, particularly, techniques of harvesting solar energy, in order to propose an attractive and equally plausible building energy enhancement scenario. CP29 – knowledge regarding the use of high energy consuming equipment coupled with energy efficient and renewable energy technologies, for the realization of indoor thermal comfort and air quality. The synergistic effect of this equipment must be plausible, relying heavily on knowledge concerning the operation of smart buildings automation.
Skills	CP24 – capable of using CAD generated architectural plans to correctly adopt adequate building services retrofitting equipment. CP25 – capable to select state of the art equipment to manage indoor air quality tailored based on building destination and preferred client-imposed requirements. CP28 – capable to select renewable energy technologies, particularly solar technologies, and evaluate their efficiency based on variable meteorological data. Capable to factor in and evaluate the effect of renewable systems based on energy calculation in comparison to a reference scenario. CP29 – capable to simulate the use of energy efficient systems based on realistic building automation systems.
Responsibilities and autonomy	CP24 – evaluating CAD generated building architectures to incorporate efficient energy saving equipment. CP25 – selection of state-of-the-art air handling equipment to achieve the targeted indoor air parameters in terms of indoor pollutants and thermal comfort considerations. CP28 – capable to provide an analysis regarding the impact of energy efficient technologies on the energy savings of a particular building based on meteorological data (TMY – typical meteorological year). CP29 – capable to simulate the use of energy efficient equipment in buildings based on the realistic behavior of the building's general automation systems, that employ the selected technology based on demand, peak consumption periods and cost benefit.

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

8.1	General objective	Implementation of new design strategies in order to minimise the energy costs and to extend the life of the systems from an aging facility
8.2	Specific objectives	Conceptual framework determination in order to be able to apply the optimal retrofit and sustainable solutions for the present-day building services. Dimensioning and economic analysis for establishing the optimum retrofit and sustainable solution for the existing building services.

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
Essentials aspects regarding the performance evaluation of the building services.	2	Presentation and discussions	Video system
Aspects regarding the building occupants' needs according to the building old or new destination.	2		
New technologies for buildings water distribution systems.	2		
New technologies for buildings HVAC systems.	2		
New technologies for buildings electrical systems.	2		
Optimal retrofit and sustainable solutions for building services.	2		
Deployment of the BMS system in buildings.	2		
Total	14		
Bibliography - ASHRAE Handbook: HVAC Basics and HVAC System Efficiency Improvement, 2016 - ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality; J. F. Kreider, P. Curtiss and A. Rabl, Heating and Cooling of Buildings: Design for Efficiency, McGraw-Hill, 2nd Ed., 2002; - McQuiston & Parker, Heating, Ventilating, and Air Conditioning Analysis and Design, Wiley, 6th Ed., 2005; R. W. Haines and D. C. Hittle, Control Systems for Heating, Ventilating and Air Conditioning, Boston: Kluwer Academic Publishers, 6th Ed., 2003; - Gh. Badea, Instalații pentru distribuția apei în clădiri, Risoprint, Cluj-Napoca, 2003; - Producers catalogues - GT 058 Ghidul criteriilor de performanța pentru instalațiile de ventilare. - GT 059 Ghidul criteriilor de performanța pentru instalațiile electrice. - GT 063 Ghidul criteriilor de performanța pentru instalații sanitare. - GT 060 Ghid pentru proiectarea instalațiilor de încălzire perimetrala la clădiri - I 13 Normativ pentru proiectarea și executarea instalațiilor de încălzire centrala - I 9 Normativ pentru proiectarea și executarea instalațiilor sanitare. - I 5 Normativ pentru proiectarea, și executarea instalațiilor de ventilare și climatizare. - I 7 Normative for design, execution and exploitation of the electrical systems for buildings. - SR EN 12464-1:2011. Lumină și iluminat. Iluminatul locurilor de muncă. Partea 1: Locuri de muncă interioare			

9.2. Project	Number of hours	Teaching methods	Notes
Project design topic presentation and assimilation. General debate on the building blueprints.	2 hours	Discussions, case study, team work.	
Performance evaluation of the effective building services: HVAC systems.	2 hours		
Performance evaluation of the effective building services: water distribution.	2 hours		
Performance evaluation of the effective building services: electrical systems.	2 hours		
Evaluation of the maintenance and operation costs for the existing building services.	2		
Comfort demand of the building occupants according to the building old or new destination: HVAC systems.	2		
Comfort demand of the building occupants according to the building old or new destination: water distribution and lighting.	2		
Design the optimal retrofit and sustainable solution for building services: HVAC systems.	2		
Design the optimal retrofit and sustainable solution for building services: water distribution.	2		
Design the optimal retrofit and sustainable solution for building services: electrical systems.	2		
Financial estimate after the implementation of the optimum retrofit and sustainable solutions of the building services.	2		
Tutoring.	2		
Oral presentation of the project.	4		
Total	28		
Bibliography 1. ASHRAE Handbook: HVAC Basics and HVAC System Efficiency Improvement, 2016 2. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality; 3. J. F. Kreider, P. Curtiss and A. Rabl, Heating and Cooling of Buildings: Design for Efficiency, McGraw-Hill, 2nd Ed., 2002; 4. McQuiston & Parker, Heating, Ventilating, and Air Conditioning Analysis and Design, Wiley, 6th Ed., 2005; 5. R. W. Haines and D. C. Hittle, Control Systems for Heating, Ventilating and Air Conditioning, Boston: Kluwer Academic Publishers, 6th Ed., 2003; 6. Gh. Badea, Instalații pentru distribuția apei în clădiri, Risoprint, Cluj-Napoca, 2003; 7. Producers catalogues 8. GT 058 Ghidul criteriilor de performanța pentru instalațiile de ventilare. 9. GT 059 Ghidul criteriilor de performanța pentru instalațiile electrice. 10. GT 063 Ghidul criteriilor de performanța pentru instalații sanitare. 11. GT 060 Ghid pentru proiectarea instalațiilor de încălzire perimetrala la clădiri 12. I 13 Normativ pentru proiectarea și executarea instalațiilor de încălzire centrala 13. I 9 Normativ pentru proiectarea și executarea instalațiilor sanitare. 14. I 5 Normativ pentru proiectarea, și executarea instalațiilor de ventilare și climatizare. 15. I 7 Normativ for design, execution and exploitation of the electrical systems for buildings.			

16. SR EN 12464-1:2011. Lumină și iluminat. Iluminatul locurilor de muncă. Partea 1: Locuri de muncă interioare

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

The competences achieved by the alumni are necessary in the field of design, production, consulting and marketing. Thus, the demands of the 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	Written exam	Test – 2 hours	50%
11.5 Seminar / laboratory / project	Oral presentation of the project	Oral examination	50%
11.6 Minimum standard of performance			
Students must pass the Laboratory test for the final exam. The components of the final grade are Exam (E) and Project (P). Thus, the formula for the final grade of this subject is $N = 0.5 \times E + 0.5 \times P$. The 4 credits are obtained only if $N \geq 5$, where both $E \geq 5$ and $P \geq 5$.			

Date of filling in: 10.05.2026		Title Surname Name	Signature
	Lecturer	Assoc.Prof.PhD.Eng. Octavian Pop	
	Teachers in charge of application	Assoc.Prof.PhD.Eng. Octavian Pop	

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