

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			Advanced Building Services - HVAC and Water Supply			Subject code	1.00	
2.2	Course responsible/lecturer			Assoc.Prof.PhD.Eng. Octavian POP, octavian.pop@insta.utcluj.ro Lecturer PhD.Eng. Dan Mureșan, Muresan.dan@insta.utcluj.ro					
2.3	Teachers in charge of project			Assoc.Prof.PhD.Eng. Octavian POP, octavian.pop@insta.utcluj.ro Lecturer PhD.Eng. Anagabriela Deac, anagabriela.deac@insta.utcluj.ro					
2.4	Year of study	1	2.5	Semester	1	2.6 Assessment			Exam
2.7 Subject category		Formative category							DF
		Optionality							D0B

3. Estimated total time

3.1 Number of hours per week	4	of which	3.2 Course	2	3.3 Seminar	-	3.3 Laboratory	-	3.3 Project	2
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar	-	3.6 Laboratory	-	3.6 Project	28
3.7 Individual study:										
(a) Exams and tests										3
(b) Manual, lecture material and notes, bibliography										21
(c) Supplementary study in the library, online and in the field										21
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										14
(e) Tutoring										7
(f) Other activities										3
3.8 Total hours of individual study (sum (3.7(a)...3.7(f)))					69					
3.9 Total hours per semester (3.4+3.8)					125					
3.10 Number of credit points					5					

4. Pre-requisites (where appropriate)

4.1	Curriculum	- Bachelor's degree
4.2	Competence	- Technical competences

5. Requirements (where appropriate)

5.1	For the course	Building Services – HVAC and Water Supply
5.2	For the applications - project	Building Services – HVAC and Water Supply

6. Specific competences

Professional competences	CP7 – lead a team in water management CP10 - ensure regulatory compliance in pipeline infrastructures CP15 – created designs for pipeline engineering CP24 – use CAD software CP25 – manage air quality
Cross competences	CT1 – collaborating in teams and networks CT2 – thinks holistically CT3 – dealing with problems

7. Expected Learning Outcomes

Knowledge	CP7 – Has in-depth knowledge of integrated water resource management principles in the urban environment, treatment and distribution technologies, European regulations, and methodologies for coordinating interdisciplinary teams in water infrastructure projects. CP10 – Knows national and European regulations regarding the design, execution, and operation of urban pipelines (drinking water, sewage), quality and safety standards, and authorization and acceptance procedures. CP15 – knowledge regarding duct types used in HVAC systems for efficient air transport CP24 – knowledge regarding principles using CAD software such as: AutoCAD, CADvent and LinfQST. Uses features such as duct design, sizing calculations, material list, balancing strategies etc., that are all included in the software package and backed up by the theory presented during class CP25 – knowledge regarding the selection of technical solutions based on air quality requirements such CO2 concentrations, VOC concentrations, moisture content etc., according to Norm IS 2022, EN 15251-2007 etc.
Skills	CP7 – Coordinates technical teams in urban water management projects (distribution networks, sewerage systems, treatment plants, sustainable drainage solutions), sets clear objectives and tasks, monitors progress, provides constructive feedback, ensures effective communication between specialties (hydraulic engineering, environment, urban planning) and with local authorities. CP10 – Verifies compliance with norms in urban pipeline projects, identifies non-conformities in the design and execution phases, proposes remedies, participates in acceptance and authorization procedures, prepares compliance documentation for authorities. CP15 – capable to critically analyse different HVAC ducting based on cross section geometry, pressure drop, pricing etc. CP24 – capable to use CADvent plugin and all adjacent software to efficiently design the entire HVAC system, capable to implement all designed steps for fast and efficient technical project realization. Also, capable to use all CAD options necessary to create clear readable blueprints for effective technical solution implementation. CP25 – capable to identify air quality level based on specific requirements, building or chamber type, and, also, capable to select the right air treatment sequences to achieve set parameters.

Responsibilities and autonomy	CP7 – Leads interdisciplinary teams in complex urban water management projects, assuming responsibility for team performance, for the quality of technical solutions, and for their integration into sustainable and regenerative urban development strategies. CP10 – Acts responsibly in verifying the compliance of urban pipeline infrastructure, aware of implications for public safety, community health, and network durability, assuming responsibility before authorities and the community. CP 15 – identifies adequate ducting material and cross section based on different specific building characteristics or features of HVAC destination (ground heat exchanger, air transfer possibilities, purification and filtering methods etc.). CP24 – correct implementation of all CAD features and ensures accordance with current technical standards to achieve a correct and usable technical project that precedes HVAC installation construction. CP25 – Ensures that the cost-effective solution delivers the expected interior comfort conditions, dilutes or extract health hazardous particles etc.
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8. Discipline objectives (as results from the *key competences gained*)

8.1	General objective	- To design, build and make technical and economic optimization of the HVAC and Water Supply systems for energy efficient buildings. - To make technical and economic coordination and control of HVAC and Water Supply systems for energy efficient buildings. - To synthesize, interpret and transmit the information on the composition and operation of advanced building services- HVAC and water supply systems. - To develop programs and applications for evaluation of operational and functional performance of different types of advanced building services - HVAC and water supply systems.
8.2	Specific objectives	- To identify the technical and functional requirements of different categories of advanced building services - HVAC and water supply systems - in relation with the requirements imposed by the building functioning and destination. - To evaluate the tasks for dimensioning advanced building services - HVAC and water supply systems - under specific functional and placement conditions. - To analyse by comparison the alternative solutions for advanced building services - HVAC and water supply systems - composition and equipping. - To analyse, evaluate and take action in specific activities of advanced building services - HVAC and water supply systems - designing, execution and operation. - To know the latest scientific and technical achievements and the national and international trends for developing the field of building services - HVAC and water supply systems -. - To know in detail the role and the action of building services components and systems corresponding to functional requisite. - To use methods and specialized computer programs for modelling advanced building services - HVAC and water supply

		systems - and for simulation of their behaviour in various functional situations.
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9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. Introduction. Types of HVAC systems. HVAC project development and system design	2	Standard and interactive teaching, supplemented by exposure through video-projector	
2. Solutions for energy efficiency design of HVAC systems	2		
3. Improving the efficiency of air distribution systems	2		
4. HVAC variable refrigerant flow systems	2		
5. Choosing high-efficiency HVAC equipment. Designing high-efficiency chilled water-systems.	2		
6. HVAC systems with recuperative heat recovery	2		
7. HVAC system with ground-air heat exchanger	2		
8. Performance criteria of quality requirements for sanitary installations in buildings	2		
9. Efficiency of sanitary installations by using dynamic balancing and temperature control	2		
10. Smart sanitary installations	2		
11. Silent and fireproof sanitary installations	2		
12. Vacuumatic sewerage installations for evacuation of meteoric waters	2		
13. Management of meteoric waters	2		
14. Decentralized supply with hot water of consumers from buildings	2		
Bibliography			
1. Roger W. Haines and Michael E. Meyers HVAC Systems Design Handbook, Fifth Edition (2009);			
2. Javad Khazaii - Energy-Efficient HVAC Design: An Essential Guide for Sustainable Building (2014);			
3. *** ASHRAE Handbook <i>HVAC Applications</i> . ASHRAE.org, Atlanta, Georgia, United States, 2019;			
4. *** ASHRAE Handbook—HVAC Systems and Equipment, 2020.			
To be completed			
9.2. Project	Number of hours	Teaching methods	Notes
1. Design topic: HVAC system and components design for a living house.	2	Presentation of calculation methods, guidance making the drawn parts	
2. Simplified heat load calculation	2		
3. Selection HVAC system - VRV	2		
4. Minimal renewal (fresh air) airflow rate calculation	2		
5. Simulation of earth-to-air heat exchanger (Canadian well)	2		
6. Selection of air handling unit with heat recovery	2		
7. Drawings of HVAC system	2		

8.Design calculations of installations for supply with hot and cold water in buildings	2		
9.Design calculations of sewerage installations for household and meteoric waters in buildings	2		
10. Hydraulic balancing methods of sanitary installations	2		
11.Design of smart sanitary installations	2		
12.Sizing of vacuumatic installation for sewerage of meteoric waters for buildings	2		
13.Sizing of infiltration tanks of meteoric waters	2		
14.Sizing of thermal modules for decentralized supply with hot household water of consumers in buildings	2		
Bibliography 1. Roger W. Haines and Michael E. Meyers HVAC Systems Design Handbook, Fifth Edition (2009); 2. Javad Khazaii - Energy-Efficient HVAC Design: An Essential Guide for Sustainable Building (2014); 3. *** ASHRAE Handbook <i>HVAC Applications</i> . ASHRAE.org, Atlanta, Georgia, United States, 2019; 4. *** ASHRAE Handbook—HVAC Systems and Equipment, 2020. 5. Henri Charlent and Patrick Agostini – Traité des installations sanitaires, 16 edition 2015 6. *** Normativ pentru proiectarea, executarea și exploatarea instalațiilor de ventilare și climatizare Indicativ I 5 – 2022 7. *** Indoor environmental input parameters for design and assessment of energy performance of buildings- addressing indoor air quality, thermal environment, lighting and acoustics 15251:2007			

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

Acquired competencies will be necessary to the employees working in the field of advanced building services - HVAC and water supply systems: design, execution, energy audit, exploitation and maintenance.

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 of checking knowledge, written and oral	Written evaluation – Test sheet (30 minutes)	66%
11.5 Project	Project presentation	Oral support of the project	34%
11.6 Minimum standard of performance			
Completion of the project conditions the entrance to the exam. Observance of the framework content of the applications according to the presentation during the semester and correct execution of the calculations The final Mark is obtained from the following formula: $N=0,66E+0.34P$; applicable if: $T \geq 5$ and $P \geq 5$. Mark components: Theory (T); Project (P).			

Date of filling in:		Title Surname Name	Signature
14.05.2026	Lecturer	Assoc.Prof.PhD.Eng. Octavian POP	
		Lecturer PhD.Eng. Dan MUREȘAN	
	Teachers in charge of application	Assoc.Prof.PhD.Eng. Octavian POP	
		Lecturer PhD Eng. Anagabriela DEAC,	

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	