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
1.8	Subject code	1.00

2. Data about the subject

2.1	Subject name				Advanced Building Services - HVAC and Water Supply		
2.2	Course responsible/lecturer				Assoc.Prof.PhD.Eng. Octavian POP, PhD octavian.pop@insta.utcluj.ro Lecturer Eng. Dan Mureșan, PhD Muresan.dan@insta.utcluj.ro		
2.3	Teachers in charge of seminars				Assoc.Prof.PhD.Eng. Octavian POP, PhD octavian.pop@insta.utcluj.ro Lecturer Eng. Anagabriela Deac, PhD 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					DA	
	Optionality					DI	

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) Manual, lecture material and notes, bibliography	21
(b) Supplementary study in the library, online and in the field	21
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	14
(d) Tutoring	7
(e) Exams and tests	3
(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	After completing the discipline, students will be able to know: - Different parts constituting heating, air conditioning and refrigeration systems for energy efficient buildings; - Types of mechanical ventilation systems that permits the regenerative exchange and circulation of air; - Draft ventilation network. Prepare and plan the ventilation layout using specialist software. Design heating or cooling systems as required. Improve efficiency of ventilation network to lower energy consumption. Know the operation modes of heating, ventilation, air conditioning and refrigeration, installations and systems; - to conceive, design, technically, functionally and economically optimize and evaluate the efficiency of sanitary installations for buildings and assembles of buildings with various destinations and functions. - to coordinate and to control execution activities, operation and maintenance of sanitary installations for buildings and assembles of buildings and various functions.
Cross competences	After completing the discipline, students will be able to demonstrate creative spirit and initiative in solving complex problems in the field of HVAC and water supply.

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

7.1	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.
7.2	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.

8. Contents

8.1. 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 *HVAC Applications.* ASHRAE.org, Atlanta, Georgia, United States, 2019;
4. *** ASHRAE Handbook—HVAC Systems and Equipment, 2020.

To be completed

8.2. 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 *HVAC Applications.* 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 2105

9. 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.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The exam consists of checking knowledge, written and oral	Written evaluation – Test sheet (30 minutes)	66%
10.5 Project	Project presentation	Oral support of the project	34%
10.6 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 ≥ 5 and P ≥ 5. Mark components: Theory (T); Project (P).			

Date of filling in:		**Title Surname Name**	**Signature**
14.06.2025	Lecturer	Assoc.Prof.PhD.Eng. Octavian POP, PhD	
		Lecturer Eng. Dan MUREȘAN, PhD	
	Teachers in charge of application	Assoc.Prof.PhD.Eng. Octavian POP, PhD	
		Lecturer Eng. Anagabriela DEAC, PhD	

Date of approval in the Department of Building Services Engineering 19.06.2025	Head of department Assoc.Prof.PhD.Eng. Ciprian BACOŢIU
Date of approval in the Council of the Faculty of Building Services Engineering 19.06.2025	Dean Assoc.Prof.PhD.Eng. Florin DOMNIŢA