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	15.00

2. **Data about the subject**

2.1	Subject name			Urban Network Management		
2.2	Course responsible/lecturer			*Assoc.Prof. PhD.Eng. Ciprian BACOŢIU - ciprian.bacotiu@insta.utcluj.ro* *Assoc.Prof. PhD.Eng. Ancuţa ABRUDAN- ancuta.abrudan@insta.utcluj.ro*		
2.3	Teachers in charge of seminars			*Senior Lecturer PhD.Eng. Cristina IACOB - cristina.iacob@insta.utcluj.ro*		
2.4 Year of study	2	2.5 Semester	1	2.6 Assessment	Exam	
2.7 Subject category	Formative category					DA
	Optionality status					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	2	3.3 Project	
3.4 Total hours in the curriculum	56	of which	3.5 Course	28	3.6 Seminar		3.6 Laboratory	28	3.6 Project	

3.7 Individual study:	
(a) Manual, lecture material and notes, bibliography	28
(b) Supplementary study in the library, online and in the field	19
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
(d) Tutoring	-
(e) Exams and tests	2
(f) Other activities	-

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	B.Sc. Engineering Diploma
4.2	Competence	

5. Requirements (where appropriate)

5.1	For the course	128-130, 21 Decembrie 1989 Blvd., Auditorium A1, Cluj-Napoca
5.2	For the applications Laboratory	128-130, 21 Decembrie 1989 Blvd., CAD Lab, Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge about: - GIS paradigm; - Urban water distribution networks; - Urban sewerage networks; - Urban district heating systems; - Multicriteria decision-making methods. Acquired skills: - To implement and use GIS tools for urban networks underground infrastructure; - To collect, store, monitorize and use information in a GIS environment; - To make decisions using multicriteria analysis; - To propose solutions of improvement of the district heating systems.
Cross competences	To demonstrate a creative and enterprising spirit in complex problem solving.

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

7.1	General objective	A comprehensive understanding of the urban underground infrastructure (water distribution systems, sewerage networks, district heating systems) using modern tools and paradigms (GIS, multicriteria analysis).
7.2	Specific objectives	Understanding the graphical representation of building services design layouts and schematics. Evaluating the results obtained by using specific CAD/GIS models/softwares for building services engineering domain. Selecting appropriate materials and technologies with respect to the particular conditions regarding the structure and positioning of different building services systems. Identifying specific technical regulations for district heating networks, water supply and sewerage systems. Adapting the calculation methods to the characteristics of building services systems and components: district heating networks, water supply and sewerage systems.

8. Contents

8.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes

		Interactive teaching methods; Multimedia presentation	Video-projector
1. Overview of the course	2		
2. Urban Water Distribution Networks	2		
3. Urban Sewerage Networks	2		
4. Overview of GIS: Definitions, components	2		
5. GIS Applications for Urban Management and Development	2		
6. Data Analysis, Spatial Queries and Basic Spatial Analysis	2		
7. Multicriteria Decision-Making Basics	2		
8. Management of urban thermal networks - generalities	2		
9. Thermal network systems: classification, pipes, connecting elements, mobile and fixed supports, expansion compensators	2		
10. External structure of central heating systems	2		
11. Hydraulic calculation of thermal networks: hydraulic calculation of hot water networks, piezometric graph of hot water networks	2		
12. Thermal calculation of district heating networks: heat loss calculation	2		
13. Calculation of temperature drop: checking the temperature at the outer surface of the thermal insulation, calculation of the optimal thickness of the thermal insulation layer	2		
14. Mechanical calculation of thermal networks: general considerations, calculation of pipe wall thickness, calculation of the distance between mobile and fixed supports, calculation of naturally elastic configurations. The case of pre-insulated pipes.	2		

Bibliography

1. Nyerges Timothy L., Jankowski P. - *Regional and Urban GIS: A Decision Support Approach*. New York: Guilford Press, 2010.

2. Maantay J., Ziegler J. - *GIS for the Urban Environment*, ESRI Press, Redlands (CA), USA, 2006.

3. Shamsi U.M. - *GIS applications for water, wastewater, and stormwater systems*. CRC Press, Boca Raton (FL), USA, 2005.

4. Grigg N.S. - *Water, Wastewater, and Stormwater Infrastructure Management*, CRC Press, Boca Raton (FL), USA, 2012.

5. Ishizaka A., Nemery P. - *Multi-criteria decision analysis: methods and software*. Wiley, Chichester, UK, 2013.

6. Enciclopedia tehnică de instalaţii - Instalaţii de încălzire, Ediţia a-II-a, Editura Artecno, Bucureşti, 2010.

7. GP 36 Ghid pentru proiectarea automatizării instalaţiilor din centrale şi puncte termice

8. I 37 – 1981 Instrucţiuni tehnice pentru echilibrarea hidraulică prin diafragme a instalaţiilor şi reţelelor termice cu apă caldă şi fierbinte

9. NP 029 – 2002 Normativ de proiectare,execuţie şi exploatare pentru reţele termice cu conducte preizolate montate în sol utilizate la transportul agentului termic de încălzire şi a apei calde de consum

10. MP 028 – 2003 Metodologie privind echilibrarea hidraulică a rețelelor termice cu apă caldă și apă fierbinte.

11. District heating application handbook - www.districtenergy.danfoss.com

12. INTERNATIONAL ENERGY AGENCY - IEA DISTRICT HEATING AND COOLING; Programme of Research, Development and Demonstration on District Heating and Cooling

13. Handbook on Planning of District Heating Networks - www.energieschweiz.ch

8.2. Laboratory	Number of hours	Teaching methods	Notes
1. QGIS Interface. Creating layers.	2	Interactive teaching methods	Video-projector
2. Creating basic maps. Vectors. Symbology.	2		
3. Attributes. Labels. Creating vectors and vector analysis. Raster data.	2		
4. Database concepts. SQL. Spatial databases in QGIS.	2		
5. Calculation of water losses according to IWA methodology and water loss management programs in urban networks.	2		
6. Analysis of urban water distribution networks using a hydraulic modeling program.	2		
7. Analysis of water quality in urban networks using a hydraulic modeling program.	2		
8. Multi-criteria analysis - methods and software.	2		
9. Multi-criteria analysis - methods and software.	2		
10. Applications to the hydraulic calculation of thermal networks: the hydraulic calculation of hot water networks.	2		
11. Applications to the thermal calculation of thermal networks: calculation of heat losses.	2		
12. Applications to the calculation of the temperature drop: checking the temperature at the outer surface of the thermal insulation, calculating the optimal thickness of the thermal insulation layer.	2		
13. Applications to the mechanical calculation of thermal networks: calculation of pipe wall thickness, calculation of distance between movable and fixed supports, calculation of naturally elastic configurations.	2		
14. Evaluation of practical work.	2		

Bibliography

1. QGIS Training Manual https://docs.qgis.org/2.14/en/docs/training_manual/

2. Badut, M. - *GIS : Sisteme informatice geografice : fundamente practice*, Editura Albastra, Cluj-Napoca, 2004

3. Green, D. Bossomaier, T. - *Online GIS and Spatial metadata*, Taylor and Francis, New York,London, 2000

5. Keller I.E. - *GIS şi modelare hidraulică pentru reţele de alimentare cu apă şi canalizare*, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2008

6. Nyerges Timothy L., Jankowski P. - *Regional and Urban GIS: A Decision Support Approach*. New York: Guilford Press, 2010.

7. Maantay J., Ziegler J. - *GIS for the Urban Environment*, ESRI Press, Redlands (CA), USA, 2006.

8. Shamsi U.M. - *GIS applications for water, wastewater, and stormwater systems*. CRC Press, Boca Raton (FL), USA, 2005.

9. Ishizaka A., Nemery P. - *Multi-criteria decision analysis: methods and software*. Wiley, Chichester, UK, 2013.

10. Enciclopedia tehnică de instalaţii - Manualul de instalaţii - Instalaţii de încălzire, Ediţia a-II-a, Editura Artecno, Bucureşti, 2010.

11. GP 36 Ghid pentru proiectarea automatizării instalaţiilor din centrale şi puncte termice

12. NP 029 – 2002 Normativ de proiectare,execuţie şi exploatare pentru reţele termice cu conducte preizolate montate în sol utilizate la transportul agentului termic de încălzire şi a apei calde de consum

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

Acquired competences will be necessary to the employees working in the field of urban water and sewerage networks design and execution, district heating systems design and execution, and urban planning.

4. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	Evaluation will be based on: - quizzes; - questions	Written exam (2 hours)	50%
10.5 Laboratory	In order to be accepted to the exam, students must properly finalize their laboratory activity (submitting in time their work and presenting it)	Evaluation along the semester	50%

10.6 Minimum standard of performance
Getting grade 5 for both theory and applications. Final grade is obtained from the following formula: $N = 0.5 \cdot T + 0.5 \cdot A$ applicable only if: $T \geq 5$ and $A \geq 5$. Grade components: Theory (T); Applications (A)

Date of filling in: 26.06.2023		Title Surname Name	Signature
	Lecturer	Assoc.Prof. PhD.Eng. Ciprian BACOŢIU (7 weeks) Assoc.Prof. PhD.Eng. Ancuţa ABRUDAN (7 weeks)	
	Teachers in charge of application	Senior Lecturer PhD.Eng. Cristina IACOB	

Date of approval in the Department of Building Services Engineering 29.06.2023	Head of department Assoc.Prof.PhD.Eng. Carmen MÂRZA
Date of approval in the Council of the Faculty of Building Services Engineering 29.06.2023	Dean Assoc.Prof.PhD.Eng. Florin DOMNIŢA