

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				Urban Network Management	Subject code	15.00	
2.2	Course responsible/lecturer				Senior Lecturer PhD.Eng. Cristina IACOB - cristina.iacob@insta.utcluj.ro			
2.3	Teachers in charge of laboratory				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					DS	
		Optionality					DOB	

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) Exams and tests									2	
(b) Manual, lecture material and notes, bibliography									28	
(c) Supplementary study in the library, online and in the field									19	
(d) Preparation for seminars/laboratory works, homework, reports, portfolios, essays									20	
(e) Tutoring									-	
(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	128-130, 21 Decembrie 1989 Blvd., CAD Lab, Cluj-Napoca

	Laboratory	
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6. Specific competences

Professional competences	CP5 – execute feasibility study CP7 – lead a team in water management CP9 – apply health and safety standards CP10 – ensure regulatory compliance in pipeline infrastructures CP13 – consider the impact of material characteristics on pipeline flows CP15 – create designs for pipeline engineering CP18 – perform pipeline routing studies CP22 – detect flaws in pipeline infrastructure
Cross competences	CT1 – collaborating in teams and networks CT2 – thinks holistically CT3 – dealing with problems

7. Expected Learning Outcomes

Knowledge	Knowledge of the principles of operation and organization of urban infrastructure systems (water supply, sewerage, energy networks) (CP7, CP18). Understanding of the basic concepts regarding the use of GIS systems in the analysis and management of urban networks (CP5). Knowledge of the principles of hydraulic modeling of water supply and sewer networks (EPANET, SWMM) (CP9, CP10). Understanding of the methods for evaluating the performance of water supply systems, including the analysis of losses and efficiency (CP18). Knowledge of modern technologies for monitoring and rehabilitation of urban infrastructure (CP13).
Skills	Use of GIS applications for the representation and analysis of data related to urban networks (CP5, CP7). Application of modeling programs (EPANET, SWMM) for analyzing the functioning of systems (CP9). Interpretation of results obtained from simulations and analyses (CP10, CP18). Evaluation of system performance and identification of operational problems (CP18, CP22). Selection of appropriate technical solutions for optimizing urban networks (CP15). Identification of defects and formulation of intervention measures (CP22).

Responsibilities and autonomy	Assumption of responsibility in the correct use of software tools and technical data (CP5). Participation in activities within interdisciplinary teams (CP7, CT1). Application of an integrated approach in the analysis of urban infrastructure (CT2, CP7). Communication of results and technical solutions in professional contexts (CT3, CP15).
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8. Discipline objectives (as results from the *key competences gained*)

8.1	General objective	Development of an integrated perspective on urban infrastructure systems (water supply, sewerage, and other utilities), through the use of modern tools for analysis and modeling (GIS, EPANET, etc.) and decision-support methods for the management and optimization of their operation.
8.2	Specific objectives	Understanding spatial representation and analysis of urban networks using GIS systems. Development of skills for using computational tools for hydraulic modeling of water supply and sewer systems. Analysis and interpretation of simulation results for evaluating the functioning of urban networks. Evaluation of the performance of urban infrastructure systems, including loss analysis and efficiency. Identification of operational problems and system defects and formulation of intervention solutions. Application of modern technologies in monitoring and management of urban infrastructure. Use of decision-support methods for selecting optimal technical solutions in urban network management.

9. Contents

9.1. Lecture (syllabus)	Number of hours	Teaching methods	Notes
1. General presentation of the course. Introduction. Role of urban infrastructure in city development	2		

2. Types of urban networks: general classification	2	Interactive teaching methods; Multimedia presentation	Video-projector
3. Water supply systems	2		
4. Sewerage systems and stormwater management	2		
5. Urban energy networks: thermal, electrical, gas	2		
6. Interdependencies and coordination of urban infrastructure systems	2		
7. General aspects of GIS: definitions, components	2		
8. GIS applications for urban management and development	2		
9. Data analysis, spatial queries, and basic spatial analysis elements	2		
10. Network modeling: principles (EPANET, SWMM)	2		
11. Management and operation of water supply and sewerage systems	2		
12. Optimization of water supply systems. Losses and efficiency	2		
13. Modern technologies and decision support in urban infrastructure management	2		
14. Review and final discussions	2		
Bibliography			
1. Grigg N.S. – Water, Wastewater, and Stormwater Infrastructure Management, CRC Press, 2012			
2. Butler D., Digman C., Makropoulos C., Davies J. – Urban Drainage, CRC Press, 2018			
3. Hamilton S., McKenzie R. – Water Management and Water Loss, IWA Publishing, 2014			
4. IWA (International Water Association) – Water Loss Specialist Group Publications			
5. IWA Publishing – Smart Water Utilities: Complexity Made Simple			
6. Najafi M. – Trenchless Technology: Pipeline and Utility Design, Construction, and Renewal, McGraw-Hill, 2005			
7. Ishizaka A., Nemery P. – Multi-Criteria Decision Analysis: Methods and Software, Wiley			
8. Nyerges T., Jankowski P. – Regional and Urban GIS: A Decision Support Approach, Guilford Press			
9. Maantay J., Ziegler J. – GIS for the Urban Environment, ESRI Press			
9.2. Laboratory	Number of hours	Teaching methods	Notes
1. QGIS interface presentation. Layer creation	2	Interactive teaching methods	Video-projector
2. Map creation and network symbolization. Vector data	2		

3. Working with attributes and labeling infrastructure elements	2		
4. Creation and editing of vector data. Vector analysis	2		
5. Raster data and their integration in urban network analysis	2		
6. Spatial databases. Use of SQL language in GIS	2		
7. Spatial analysis and queries for urban networks	2		
8. Integrated GIS application for urban infrastructure	2		
9. Analysis of urban water distribution networks using hydraulic modeling software	2		
10. Analysis of water quality in urban distribution networks using hydraulic modeling software	2		
11. Determination of water losses using IWA methodology and water loss management programs	2		
12. Integrated case study: GIS analysis and modeling of an urban system	2		
13. Study visit to a water utility company. Use of GIS and monitoring systems in network operation	2		
14. Verification of laboratory works	2		
Bibliography 1. Shamsi U.M. – GIS Applications for Water, Wastewater, and Stormwater Systems, CRC Press 2. Shamsi U.M. – GIS Tools for Water, Wastewater, and Stormwater Systems, ASCE Press 3. QGIS Documentation & Training Manual (https://docs.qgis.org) – official QGIS Training Manual 4. EPA (U.S. Environmental Protection Agency) – EPANET 2 User Manual 5. EPA – EPANET Training Manuals and Example Projects (OpenEPANET / EPA resources) 6. EPA – Storm Water Management Model (SWMM) User Manual 7. EPA – SWMM Reference Manuals (Hydrology, Hydraulics, Water Quality) 8. OpenSWMM / OpenEPANET – Knowledge Base, Tutorials and Case Studies			

10. 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.

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	Evaluation will be based on: - quizzes; - questions	Written exam	50%

11.5 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%
11.6 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:		Title Surname Name	Signature
14.05.2026	Lecturer	Senior Lecturer PhD.Eng. Cristina IACOB	
	Teachers in charge of application	Senior Lecturer PhD.Eng. Cristina IACOB	

Date of approval in the Department of Building Services Engineering	Head of department Assoc.Prof.PhD.Eng. Ciprian BACOTIU
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	