SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Faculty of Environmental Science and Engineering**
1.3 Department	**Department of Environmental Analysis and Engineering**
1.4 Field of study	**Risk Assessment and Environmental Security**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Environmental Management and Sustainable Developement**

2. Information regarding the discipline

2.1 Name of the discipline		**INTEGRATED MANAGEMENT OF WATER RESOURCES AND PROCEDURES FOR WASTEWATER TREATMENT NME8212**					
2.2 Course coordinator		**Associate professor PhD Radu Mihăiescu**					
2.3 Seminar coordinator		**Associate professor PhD Radu Mihăiescu**					
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	35
Additional documentation (in libraries, on electronic platforms, field documentation)	45
Preparation for seminars/labs, homework, papers, portfolios and essays	47
Tutorship	15
Evaluations	16
Other activities:	-

3.7 Total individual study hours	158
3.8 Total hours per semester	200
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	
5.2. for the seminar /lab	

activities	

6. Specific competencies acquired

Professional competencies	• Explain the concept and principles of Integrated Water Resource Management (IWRM) • Describe the methodologies and tools for practicing IWRM • Analyze the EU WFD as an example of IWRM in practice • Work with integrated water management projects and get a fair insight in in the EU WFD • describe different methods for wastewater treatment and environmental effects of wastewater • apply methods from mathematical modelling to describe different waste water treatment processes • apply simulation tools for waste water treatment, and to interpret and evaluate the results • grasp the microbiological processes in the activated sludge process • account for how automatic control is used to optimise the waste water treatment
Transversal competencies	• Autonomy and responsibility. • Relational attitude and open, honest, cooperative, responsive communication. • Analysis and interpretation availability of values that describe a situation, event or behavior. • Foster imagination, willingness to conduct self in relation to others based on empathy and receives messages with emotional content. • Acceptance evaluation from others. • moral integrity, balance of character, and strength of conviction critical in promoting positive values authentic social community

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To provide a broad background on the occurrence, use, management, and conservation of water and water resources. • To understand physical hydrology and the hydrologic basis of water resources. • The course gives insights in the theoretical and methodological elements underlying the notion of 'integrated water resources management' (IWRM), with focus on concepts and tools for sustainable planning and management of water resources. • To introduce the problem-solving concepts and tools commonly used in environmental engineering, • To present the fundamental operations and processes that are used in environmental engineering, with a focus on water and wastewater treatment processes.
7.2 Specific objective of the discipline	Explain what wastewater is and describe how it is characterized. Describe the objectives and importance of (i) physical treatment, (ii) biological treatment, and (iii) chemical treatment in the handling of municipal wastewater. (1) Students will be able to analyze wastewater data and develop a preliminary design of the primary, secondary, advanced, and sludge treatment processes for a wastewater treatment plant. (2) Students will be able to perform a preliminary analysis of biological, physical, and chemical process operations within a wastewater treatment plant. (3) Students will demonstrate a basic knowledge of environmental laws and regulations that impact on the planning, design, and operation of a

	wastewater treatment facility For each treatment stage, identify and explain the engineering design principles for the most commonly implemented unit operations. For biological treatment, use biokinetic models to design treatment systems (aerobic and anaerobic). Evaluate the advantages and disadvantages of the common methods for sludge handling and disposal. Given a case study on a defined wastewater stream, design a process flow diagram and size each of the unit operations required to treat the stream such that the effluent meets a defined set of standards. • Justify why the treatment of wastewater is important and analyze the strengths and limitations of the current standards and regulations.

8. Content

8.1 Course	Teaching methods	Remarks
1. Water cycle. Water distribution on Earth. Natural characteristics of surface and underground water.	• Interactive exposure • Explanation • Conversation	
2. Role of natural factors in defining watershed evolution. Natural and human induced changes.	• Interactive exposure • Explanation • Conversation	
3. The necessity of integrated water management. History of water management. Concepts and theoretical perspectives on IWRM. Principles, methodologies & tools for practising IWRM	• Interactive exposure • Explanation • Conversation	
4. Cross-cutting global issues in IWRM, e.g., stakeholder participation, gender, public-private debate	• Interactive exposure • Explanation • Conversation	
5. EU WFD as an example of IWRM in practice,including transboundary management aspects	• Interactive exposure • Explanation • Conversation	
6. Small individual research project with focus on the implementation of the WFD.	• Interactive exposure • Explanation • Conversation	
7. History of Water Treatment. Assessing water quality - Comparison of various criteria WHO, European Union, EPA	• Interactive exposure • Explanation • Conversation	
8. Wastewater Characteristics & Regulations Wastewater Constituents. Treatment Objectives. Wastewater Regulations. Measurement of Wastewater Constituents	• Interactive exposure • Explanation • Conversation	
9. Unit Operations in Wastewater Treatment	• Interactive exposure • Explanation • Conversation	
10. Preliminary Treatment. Screening	• Interactive exposure • Explanation • Conversation	

11. Primary Treatment. Sedimentation (Types I, II and III Settling)	• Interactive exposure • Explanation • Conversation	
12. Secondary Treatment**.** Microbial Metabolism and Growth Kinetics. Wastewater Treatment Modeled as a CSTR without Recycle. The Activated Sludge Process. Trickling Filters	• Interactive exposure • Explanation • Conversation	
13. Sludge Treatment and Disposal**.** Sludge Thickening Anaerobic Digestion Sludge Dewatering Sludge Disposal	• Interactive exposure • Explanation • Conversation	
14. Tertiary Treatment (Nutrient Removal). Nitrification / Denitrification Phosphorus Removal	• Interactive exposure • Explanation • Conversation	

Bibliography

1. Ianculescu, O., Ionescu, Gh., Racovițeanu Raluca (2001), Epurarea apelor uzate, Ed. Matrix Rom, Bucureşti.
2. Mihăiescu, R. (2015), Integrated management of water resources and procedures for wastewater treatment, lecture notes.
3. Robescu, D., Robescu, Diana, Szabolcs, L., Constantinescu, I. (2000), Tehnologii, instalaţii şi echipamente pentru epurarea apelor, Ed. Tehnică, Bucureşti.
4. Robescu, D., Szabolcs, L., Robescu, Diana, Verestoy, A. (2004), Wastewater treatment technologies, installations and equipments. Ed. Tehnică, Bucureşti.
5. Rojanschi, V., Ogneanu, T. (1989), Cartea operatorului din staţiile de tratare şi epurare a apelor. Ed. Tehnică, Bucureşti
6. Stoianovici, S., Robescu, D. (1982), Procedee si echipamente necesare pentru tratarea si epurarea apei. Ed. Tehnica, Bucuresti
7. Teodosiu, Carmen (2001), Tehnologia apei potabile şi industriale, Ed. Matrix Rom, Bucureşti.
8. http://www.un.org/waterforlifedecade/iwrm.shtml
9. http://www.unece.org/fileadmin/DAM/env/water/publications/NPD_IWRM_study/ECE_MP.WAT_44_en.pdf
10. http://unesdoc.unesco.org/images/0018/001818/181891E.pdf
11. http://www.unwater.org/downloads/GWP-INBOHandbookForIWRMinBasins.pdf

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Analysis of factors that shape the nature of watersheds	• Interactive exposure • Explanation • Brainstorming	
2. Natural and human induced changes	• Interactive exposure • Explanation • Brainstorming	
3. Rehabilitation of water courses	• Interactive exposure • Explanation • Brainstorming	
4. Criteria of water monitoring, assessment and management according to WFD	• Interactive exposure • Explanation • Brainstorming	
5. Watershed management plan. Study cases Romania	• Interactive exposure • Explanation • Brainstorming	
6. Criteria of selecting wastewater treatment technologies. Field trip to WWTP Cluj	• Interactive exposure • Explanation • Brainstorming	
7. Discussion of case studies. Powerpoint presentations and essays.	• Lab assignment • thematic analysis	

Bibliography
1. Ianculescu, O., Ionescu, Gh., Racovițeanu Raluca (2001), Epurarea apelor uzate, Ed. Matrix Rom, Bucureşti.
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4. Robescu, D., Szabolcs, L., Robescu, Diana, Verestoy, A. (2004), Wastewater treatment technologies, installations and equipments. Ed. Tehnică, Bucureşti.
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6. Stoianovici, S., Robescu, D. (1982), Procedee si echipamente necesare pentru tratarea si epurarea apei. Ed. Tehnica, Bucuresti
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10. http://unesdoc.unesco.org/images/0018/001818/181891E.pdf
11. http://www.unwater.org/downloads/GWP-INBOHandbookForIWRMinBasins.pdf

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

• The discipline ensures an adequate technical and scientifically training allowing the students to integrate the knowledge gathered in the purpose of their formation as environmental specialists.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	• The correctness and completeness of the accumulated knowledge.	Written exam (in the regular session)	75%
10.5 Seminar/lab activities	• An environmental project developed	Evaluation of the project (documentation and demonstration)	25%
10.6 Minimum performance standards			
Each student has to prove that (s)he acquired an acceptable level of knowledge and understanding of the: - Identify and classify the different sources of wastewater and their requirement for treatment depending on their discharge or final utilization; - Design the various physical and chemical unit operations for wastewater treatment; - Design the various biological unit operations for wastewater treatment; - Describe the principles of various advanced treatment, concepts of water recycling and desalination. • Final Essay • Successful passing of the exam is conditioned by the final grade that has to be at least 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
20.04.2017	Associate professor PhD Radu Mihăiescu	Associate professor PhD Radu Mihăiescu

Date of approval Signature of the head of department