SYLLABUS

1. Information regarding the program

1.1 Higher education institution	Babeş-Bolyai University, Cluj-Napoca
1.2 Faculty	Chemistry and Chemical Engineering
1.3 Department	Chemical Engineering
1.4 Field of study	Chemical Engineering
1.5 Study cycle	Master
1.6 Study program / Qualification	Advanced Chemical Process Engineering / Master degree

2. Information regarding the discipline

2.1 Name of the discipline	Environmental Depollution Processes – **CME6425**						
2.2 Course coordinator	Assoc. prof. Cerasella Indolean, PhD						
2.3 Recitation coordinator	Assoc. prof. Cerasella Indolean, PhD						
2.4. Year of study	II	2.5 Semester	IV	2.6. Type of evaluation	E	2.7 Type of discipline	DS/Ob

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					10
Preparation for recitations/labs, homework, papers, portfolios and essays					14
Tutorship					1
Evaluations					4
Other activities:					-

3.7 Total individual study hours	69
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. Curriculum	• None
4.2. Competencies	• None

5. Conditions (if necessary)

5.1. for the course	• Students will be present at courses with their mobile phones turned off • Late presence at courses will not be accepted
5.2. for the seminar /lab activities	• Students will be present at recitations/labs with their mobile phones turned off • Homework solving/lab protocol is requested for the next meeting • A penalty of 0.5 points/day will be applied if the papers lab reports are not submitted as requested • Students will be present in laboratory with lab coat, gloves, lab cloth.

	• Students cannot leave an experiment unattended • It is forbidden to eat in the laboratory

6. Specific competencies acquired

Professional competencies	• Define notions, concepts, theories and models in the field of quality and environmental protection and their proper use professional communication • Use of advance knowledge of chemistry and chemical engineering to explain and interpret specific environmental processes • Identify and apply the advanced concepts, methods and theories for solving specific environmental problems • Critical analysis and use of advanced methods and techniques for quantitative and qualitative evaluation of processes applied in environmental protection • Defining language and identify advanced concepts for specific environmental processes and equipment • Use of advanced design knowledge to identify possible solutions for designing complex devices and equipment used in materials and environmental engineering • Evaluation and critical analysis of specific environmental processes in order to propose new solutions of design • Creative use of analysis and synthesis in developing remediation technologies • Ability to choose a method for effluent gas treatment according to its composition and physicochemical characteristics • Ability to design process flows for treating these flue gas effluents • Ability to choose a method of treatment for wastewaters depending on the content and type of pollutants • Ability to design process flows for wastewaters • Ability to choose a soil remediation method according to its characteristics and the present pollutant • Ability to calculate and interpret remediation processes performances and to prepare mass balances for these processes
Transversal competencies	• Execution of the tasks required under specified requirements and the deadlines imposed, in compliance with professional ethics and moral conduct, following a predetermined work plan • Solving tasks in accordance with the general objectives established by integrating into a working group • Permanent information and documentation in its field, in Romanian • Seeking to improve working results by engaging in professional activities • Ability to prepare written reports and to make these reports public

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

7.1 General objective of the discipline	• Gaining theoretical knowledge regarding pollutants presence in the environment and their removal from water, air and soil
7.2 Specific objective of the discipline	• Gaining theoretical knowledge regarding air and soil pollution and control techniques • Gaining advanced theoretical knowledge regarding chemical methods used in industrial wastewater treatment

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Environment. Atmosphere. Hydrosphere. Geosphere. Biosphere. Air pollution. Composition of atmosphere. Definitions. Legislation. Primary pollutants. Secondary pollutants.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.2. The air pollution. Migration of pollutants.	Lecture; Explanation; Conversation; Description; Case	2 h

Pollution sources (mobile, stationary). The main air pollutants. Measurements to limit air pollution.	study; Questioning	
8.1.3. The main air pollutants: CO, CO_2, NO_x, SO_2, VOC, PM. Description, effects, obtaining reactions, depollution methods.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.4. Methods for removing gaseous pollutants emitted by mobile sources.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.5. Removing methods for the main air pollutants from gaseous effluents emitted by stationary sources.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.6. Water pollution. Terminology. Sources of pollution. Industrial wastewater.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.7. Neutralization, precipitation and extraction – as methods for reducing the concentration of pollutants from wastewater.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.8. Adsorption. Removal of organic compounds from wastewater.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.9. Ion exchange. Retention of heavy metals from wastewater.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.10. Soil pollution. Physical properties of the soil. Sources of soil and groundwater pollution.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.11. Organic pollutants. Inorganic pollutants. Migration of pollutants. Prevention of water and soil pollution.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.12. Physical methods for soil depollution. Chemical methods for soil depollution. Current legislation.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.13. Thermal methods of soil depollution.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.14. Biological methods of soil depollution. Combined methods.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h

Bibliography

1. Electronic lecture support, 2023.

Supplementary bibliography

1. E. Dumitriu şi V. Hulea, *Metode catalitice eterogene aplicate în protecţia mediului*, Bit, Iasi, 1997.
2. Gh. Iordache, *Metode şi utilaje pentru prevenirea poluării mediului*, Editura Matrix Rom, Bucureşti, 2003.
3. K.B. Schnelle, Ch.A. Brown, *Air Pollution Control Technology Handbook*, CRC Press, London, 2002.
4. R.M. Heck, R. J. Farrauto, S.T. Gulati**,** *Catalytic Air Pollution Control. Commercial Technology*, ediţia a2a, J. Wiley and Sons, New York, 2002.
5. K. Wark, C.F. Warner, W.T. Davis, *Air Pollution its Origin and Control*, editia a3a, Addison Wesley Longman, Berkeley, California, 1998.
6. C.D. Cooper, F.C. Alley, *Air Pollution Control. A Design Approach*, editia a3a, Waveland Press Inc., Long Grove, Illinois, 2002.
7. J.C. Crittenden, R.R. Trussell, D. W. Hand, K.J. Howe, G. Tchobanoglous, *Water Treatment: Principles and Design*, 2nd Edition, MWH, Wiley & Sons, 2005.
8. T. Oppenlander, *Photochemical Purification of Water and Air*, Wiley VCH, 2003.
9. C. Teodosiu, *Tehnologia apei potabile şi industriale*, Editura Matrix Rom, Bucureşti, 2001.
10. D. Baciu, *Tehnici, utilaje şi tehnologii de depoluare a apelor reziduale*, Editura Risoprint, Cluj-Napoca, 2001.

11. N. Dulămiţă,M. Stanca, *Tehnologie chimică*, Presa Universitară Clujeană,Cluj-Napoca, 1999.
12. M. Macoveanu, D. Bilba, N. Bilba, M. Gavrilescu, G. Soreanu, *Procese de schimb ionic in protectia mediului*, Editura Matrix Rom, Bucuresti, 2002.
13. Gh. Blaga, F. Filipov, I. Rusu, S. Udrescu, D. Vasile, *Pedologie*, Editura AcademicPres, Cluj-Napoca, 2005.
14. Gh. Neag, *Depoluarea solurilor şi apelor subterane*, Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 1997.
15. V. Ivanovici, V. Stiopol şi E. Constatinescu, *Mineralogie*, Editura Didactică şi Pedagogică, Bucureşti, 1979.

8.2 Laboratory	Teaching methods	Remarks
8.2.1. Phenol removal from wastewaters by adsorption on activated carbon (batch conditions).	Experiment; Explanation; Conversation; Description; Questioning	4 h / lab (3 meetings) 12 h
8.2.2. Organic compounds removal from wastewaters by catalytic oxidation.	Experiment; Explanation; Conversation; Description; Questioning	
8.2.3. Phenol removal from wastewaters by adsorption on activated carbon (fixed bed).	Experiment; Explanation; Conversation; Description; Questioning	
8.2.4. Project	Conversation; Scientific project supporting on a topic imposed by the seminar coordinator.	14 h
8.2.7. Evaluation	Test	2 h

Bibliography

1. Stanca, M., Măicăneanu, A., Indolean, C., *Caracterizarea, valorificarea şi regenerarea principalelor materii prime din industria chimică şi petrochimică*, Ed. Presa Universitară Clujeană, 2007.
2. Burcă, S., Măicăneanu A., Indolean, C., Stanca, M., *Tehnologie Chimică organică. Tehnologii de depoluare a mediului. Aplicații practice*, Editura Presa Universitară Clujeană, Cluj-Napoca, 2013.
3. Laboratory protocols

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

By acquiring theoretical and methodological concepts and addressing practical aspects included in the **Environmental depollution processes** discipline, the students will get the knowledge in accordance with required competencies from Diploma supplement and ANC's qualifications

10. Evaluation

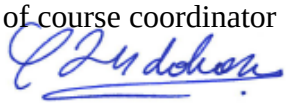
Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The correctness of answers - learning and understanding of the treated issues	Evaluation is done on two dimensions: written exam (80%) and laboratory report projects (10% + 10%). The access to the exam is conditioned by the laboratory colloquium and the lab reports presentation, corresponding to all practical work. Fraud intention is punishable by removal from the examination room. Examination fraud is punishable by expulsion according to UBB ECST regulation.	80%
	Way of thinking, correctness and proposed solutions argumentation		

10.5 Recitation/lab activities	Lab reports submission	The laboratory reports, corresponding to all practical works must be delivered at the end of each online lab session activity. Supporting a project by each student, on a topic chosen from a list imposed by the recitation coordinator.	10%
	Lab reports quality, correct utilization of literature data		
	Laboratory/recitation activity		10%
10.6 Minimum performance standards			
• 5 (five) grade • Knowledge of the main treatment techniques for polluted air, water, soil			

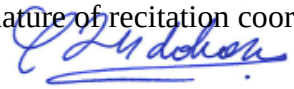
Date

10 April 2024

Signature of course coordinator



Signature of recitation coordinator



Date of approval

22.04.2024

Signature of the head of department

Prof. eng. PhD Graziella Turdean