

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 (ICAP) / 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/Opt.

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 recitation/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 recitation/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	<ul style="list-style-type: none"> • None
4.2. Competencies	<ul style="list-style-type: none"> • None

5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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

	<p>not submitted as requested</p> <ul style="list-style-type: none"> • 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
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6. Specific competencies acquired

Professional competencies	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Gaining theoretical knowledge regarding pollutants presence in the environment and their removal from water, air and soil
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> • 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. Air pollution. Terminology. Pollutant migration. Pollution sources (mobile, stationary). Main air pollutants. Measures for air pollution limitation.*	Lecture; Explanation; Conversation; Description; Case study; Questioning	1 h
8.1.2. Methods for removing gaseous pollutants emitted from mobile sources. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	3 h
8.1.3. Methods for removing main gaseous pollutants emitted from stationary sources.*	Lecture; Explanation; Conversation; Description; Case study; Questioning	3 h
8.1.4. Water pollution. Terminology. Pollution sources. Industrial wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	1 h
8.1.5. Reducing the concentration of pollutants in wastewaters by neutralization and extraction.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.6. Adsorption. Removal of organic compounds from wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.7. Ionic exchange. Heavy metal ions removal from wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.8. Membrane processes used for wastewater treatment. Micro-, ultra-, nano-filtration, reverse osmosis, electro dialysis.	Lecture; Explanation; Conversation; Description; Case study; Questioning	1 h
8.1.9. Advanced chemical oxidation. Ozone, hydrogen peroxide, Fenton reagent.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.10. Wastewater photocatalytic purification. Principles, reagents, reactors.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.11. Industrial wastewaters treatment. Case studies.	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.12. Soil and underground water pollution sources. Pollutants migration. Water and soil pollution prevention. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	3 h
8.1.13. Physical methods for soil treatment. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h
8.1.14. Chemical and thermal soil treatment methods. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	2 h

* Addressing of the above mentioned themes will be made differentiated according to the origin of the students, taking into consideration the fact that flue gas treatment and soil remediation techniques issues are included in an optional discipline for only one study programme in chemical engineering.

Bibliography

1. Electronic lecture support

Supplementary bibliography

1. E. Dumitriu și V. Hulea, *Metode catalitice eterogene aplicate în protecția mediului*, Bit, Iasi, 1997.
2. Gh. Iordache, *Metode și utilaje pentru prevenirea poluării mediului*, Editura Matrix Rom, București, 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*, ediția 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 și industriale*, Editura Matrix Rom, București, 2001.
10. D. Baci, *Tehnici, utilaje și tehnologii de depoluare a apelor reziduale*, Editura Risoprint, Cluj-Napoca, 2001.
11. N. Dulămiță, M. Stanca, *Tehnologie chimică*, Presa Universitară Clujeană, Cluj-Napoca, 1999.
12. M. Macoveanu, D. Bilba, N. Bilba, M. Gavrilăscu, G. Soreanu, *Procese de schimb ionic în protecția mediului*, Editura Matrix Rom, București, 2002.
13. Gh. Blaga, F. Filipov, I. Răsu, S. Udrescu, D. Vasile, *Pedologie*, Editura Academică, Cluj-Napoca, 2005.
14. Gh. Neag, *Depoluarea solurilor și apelor subterane*, Editura Casa Cărții de Știință, Cluj-Napoca, 1997.
15. V. Ivanovici, V. Stîopol și E. Constatinescu, *Mineralogie*, Editura Didactică și Pedagogică, București, 1979.

8.2 Recitation / 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 și regenerarea principalelor materii prime din industria chimică și 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	<p>The correctness of answers - learning and understanding of the treated issues</p> <p>Way of thinking, correctness and proposed solutions argumentation</p>	Online evaluation is done on two dimensions: written exam (70%) and laboratory report projects (10% + 20%). Exams written online, on the Microsoft Teams (MT) platform (with different subjects for each student; the grind test type, containing the synthesis questions with multiple	70%

		answers). 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.	
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, online (MT platform), on a topic chosen from a list imposed by the recitation coordinator.	10%
	Lab reports quality, correct utilization of literature data		
	Laboratory/recitation activity		20%
10.6 Minimum performance standards			
<ul style="list-style-type: none"> • 5 (five) grade • Knowledge of the main treatment techniques for polluted air, water, soil 			

Date

Signature of course coordinator

Signature of recitation coordinator

15 April 2021

Date of approval

Signature of the head of department

April 25, 2021

Prof. eng., PhD Graziella Turdean