SYLLABUS

1. Information regarding the programme

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 programme / Qualification	ICAP / master degree

2. Information regarding the discipline

2.1 Name of the discipline			Environmental depollution processes – **CME6425**				
2.2 Course coordinator			Assoc. Prof. dr. eng. Andrada Măicăneanu				
2.3 Seminar coordinator			Assoc. Prof. dr. eng. Andrada Măicăneanu				
2.4. Year of study	II	2.5 Semester	4	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 laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 laboratory	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					56
Additional documentation (in libraries, on electronic platforms, field documentation)					30
Preparation for seminars/labs, homework, papers, portfolios and essays					14
Tutorship					4
Evaluations					4
Other activities:					-

3.7 Total individual study hours	108
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

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 seminaries/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 (essays) are not submitted as requested

	• Students will be present in laboratory with lab coat, gloves, lab cloth. • Students can not leave unattended an experiment • 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. Air pollution. Terminology. Pollutant migration. Pollution sources (mobile, stationary). Main air pollutants. Measures for air pollution limitation.*	Lecture; Explanation; Conversation; Description; Case study; Questioning	

8.1.2. Methods for removing gaseous pollutants emitted from mobile sources. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.3. Methods for removing main gaseous pollutants emitted from stationary sources.*	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.4. Water pollution. Terminology. Pollution sources. Industrial wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.5. Reducing the concentration of pollutants in wastewaters by neutralization and extraction.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.6. Adsorption. Removal of organic compounds from wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.7. Ionic exchange. Heavy metal ions removal from wastewaters.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.8. Membrane processes used for wastewater treatment. Micro-, ultra-, nano-filtration, reverse osmosis, electrodialysis.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.9. Advanced chemical oxidation. Ozone, hydrogen peroxide, Fenton reagent.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.10. Wastewater photocatalytic purification. Principles, reagents, reactors.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.11. Industrial wastewaters treatment. Case studies.	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.12. Soil and underground water pollution sources. Pollutants migration. Water and soil pollution prevention. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.13. Physical methods for soil treatment. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	
8.1.14. Chemical and thermal soil treatment methods. *	Lecture; Explanation; Conversation; Description; Case study; Questioning	

** 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. Kohl A., Nielsen R., *Gas Purification*, Gulf Publ.,Houston, 1997.
2. Astarita G., Savage D.V., Bisio A., *Gas Treating with Chemical Solvents*, Wiley, New York, 1983
3. Siminiceanu I., *Procese chimice gaz-lichid*, Ed. Tehnopres Iasi, 2004.
4. Levenspiel O., *Chemical Reaction Engineering,*Wiley, New York, 1999.
5. Syekely J., Ewans J.W., Sohn H.Y., *Gas-Solid Reactions*, Academic Press New York, 1976.
6. Dragan S., Siminiceanu, I., *Studii de caz în procese chimice gaz-lichid şi gaz-solid necatalitice*, Editura Risoprint, Cluj-Napoca, 2006.
7. Surpăţeanu M., *Elemente de chimia mediului*, Editura Matrix Rom, Bucureşti, 2004.
8. Teodosiu C., *Tehnologia apei potabile şi industriale*, Editura Matrix Rom, Bucureşti, 2001.
9. Baciu D., *Tehnici, utilaje şi tehnologii de depoluare a apelor reziduale*, Editura Risoprint, Cluj-napoca, 2001.
10. Dulămiţă N., Stanca M., *Tehnologie chimică*, Presa Universitară Clujeană, 1999.
11. Stanca M., Măicăneanu A., Indolean C., *Caracterizarea, valorificarea şi regenerarea principalelor materii prime din industria chimică şi petrochimică*, Presa Universitară Clujeană, 2007.

8.2 Laboratory	Teaching methods	Remarks
8.2.1. Phenol removal from wastewaters by adsorption on activated carbon (batch conditions).	Explanation, conversation, description, questioning	4 h / lab (3 meetings)
8.2.2. Organic compounds removal from wastewaters by catalytic oxidation.	Explanation, conversation, description, questioning	
8.2.3. Phenol removal from wastewaters by adsorption on activated carbon (fixed bed).	Explanation, conversation, description, questioning	
8.2.7. Evaluation	Test	2 h

Bibliography

1. N. Dulămiță, M.Stanca, Tehnologie chimică, Presa Universitară Clujeană, 1999;
M.Jitaru, .Stanca, N.Dulămiță, Tehnologie Chimică Generală, partea I., Ed. Univ. Babeş-Bolyai, 1998;
2. J.A.Moulijn, M. Makke, A, van Diepen, Chemical Process Technology, Wiley Publishing, 2001;
3. C. Teodosiu, Tehnologia apei potabile şi industriale. Ed. Matrix Rom. Bucureşti, 2001;
4. M.Stanca, A. Măicăneanu, Caracterizarea, valorificarea şi regenerarea principalelor materii prime din industria chimică şi petrochimică, Ed. Presa Universitară Clujeană, 2007.
5. N.Dulămiță, M.Fodorean, Tehnologie Chimică, Vol.3, Ed. Univ. Babeş-Bolyai Cluj-Napoca, 1990;
6. N.Dulămiță, M.Stanca, F. Irimie, F. Buciuman, Lucrări practice la tehnologie chimică generală, vol.1. Univ. Babeş-Bolyai, Cluj-Napoca, 1994.
7. referate laborator

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, students are acquiring a solid knowledge base, according to partial competences required for possible occupations listed in grid 1/2 - RNCSIS.

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	Written examination - access is conditioned by essays submission. Fraud intention punishable by removal from the examination room. Examination fraud is punishable by expulsion according to UBB ECST regulation.	60%
	Way of thinking, correctness and proposed solutions argumentation		
10.5 Seminar/lab activities	Essay submission	Essays must be delivered no later than the last week of teaching activity	40%
	Essay quality, correct utilization of literature data		
	Laboratory/seminar activity		
10.6 Minimum performance standards			
• 5 (five) grade for each module • Knowledge of the main treatment techniques for polluted air, water, soil			

Date	Signature of course coordinator	Signature of seminar coordinator
March 25, 2016	.....	.....

Date of approval	Signature of the head of department
.....	.....….....