SYLLABUS

1. Information regarding the programme

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

2. Information regarding the discipline

2.1 Name of the discipline		Hazards and technological risks					
2.2 Course coordinator		Assoc. Prof. Dr. Ing. Török Zoltán					
2.3 Seminar coordinator		Assoc. Prof. Dr. Ing. Török Zoltán					
2.4. Year of study	**III**	2.5 Semester	**VI**	2.6. Type of evaluation	**C**	2.7 Type of discipline	Compulsory

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					7
Additional documentation (in libraries, on electronic platforms, field documentation)					5
Preparation for seminars/labs, homework, papers, portfolios and essays					
Tutorship					0
Evaluations					2
Other activities:					

3.7 Total individual study hours	14
3.8 Total hours per semester	70
3.9 Number of ECTS credits	3

4. Prerequisites (if necessary)

4.1. curriculum	- knowledge of the fundamental elements of environmental science and engineering: chemistry, mathematics, thermodynamics, unit operations
4.2. competencies	- Technical; use of the computer;

5. Conditions (if necessary)

5.1. for the course	- requires digital projector and laptop
5.2. for the seminar /lab activities	- access to computers for the use of databases

6. Specific competencies acquired

Professional competencies	- ability to identify hazardous substances by their properties - knowledge of the concepts and principles of achieving the identification of chemical risks in a process;
Transversal competencies	- the ability to conduct literature research in all existing formats; - knowledge of the use of databases;

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

7.1 General objective of the discipline	- identifying hazards in certain technological processes and key factors contributing to technological risk;
7.2 Specific objective of the discipline	- the acquisition of the terminology of technological hazard and risk; - knowledge of the use of databases with information on chemical substances: EC Inventory, CAMEO, etc. - knowledge of how to prepare the notification of hazardous substances based on legal requirements; - identification of hazardous processes within a chemical site.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to Technological Hazard and Risk Theory (Part 1)	lecture, interactive discussions	Hazard Theory. Terminology aspects: hazard, risk, vulnerability, exposure, resilience. Examples of accidents.
2. Introduction to Technological Hazard and Risk Theory (Part 2)	lecture, interactive discussions	The framework of risk analysis: identification, analysis, evaluation, management. Risk assessment methodologies
3. Hazardous chemicals (part 1)	lecture, interactive discussions	European and national legislation: REACH, CLP, GHS, HG 539/206, GD 1408/2008.
4. Hazardous chemicals (part 2)	lecture, interactive discussions	Classification of hazards: flammability, explosive character, toxicity, reactivity, corrosivity, etc.

5. Hazardous chemicals (part 3)	lecture, interactive discussions	Labelling of hazardous substances. Safety Data Sheets.
6. Hazardous chemicals (part 4)	lecture, interactive discussions	Key chemical properties: flammability. Fire hazard. Prevention and control.
7. Hazardous chemicals (part 5)	lecture, interactive discussions	Key chemical properties: explosiveness Explosion hazard (gas, powder, solid) Prevention and control.
8. Hazardous chemicals (part 6)	lecture, interactive discussions	Proprietăți chimice cheie: caracterul toxic Hazardul de dispersie toxică în atmosferă
9. Notification of hazardous substances.	lecture, interactive discussions	Legislative requirements regarding the preparation of the notification. Content. Examples.
10. Dangerous chemical reactions. Factors influencing the risk of run-away reactions.	lecture, interactive discussions	Thermodynamics and chemical kinetics. Examples.
11. Hazard at molecular level	lecture, interactive discussions	Thermodynamics and chemical kinetics. Presentation of the CHETAH method. Examples.
12. REHRA (Rapid Environmental and Health Risk Assessment) method	lecture, interactive discussions	Presentation of the method. Examples.
13. The DOW's FEI (Fire and Explosion Index) analysis	lecture, interactive discussions	Presentation of the method. Examples.
14. Summary course. General conclusions.	lecture, interactive discussions	

References:

Books:

Frank P. Lees: Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, Second edition, United Kingdom, 1996.

Van den Bosch, C. J. H., Weterings R.A.P.M: „Yellow Book": Methods for the Calculation of Physical Effects, Third edition, Committee for the Prevention of Disasters, Netherlands, 1997.

P.A.M. Uijit de Haag, B.J.M. Ale: „Purple Book": Guidelines for Quantitative Risk Assessment, First edition, Committee for the Prevention of Disasters, Hague, 1999.

C. A. Ericson: *Hazard Analysis Techniques for System Safety*, Ed. Wiley-Interscience, New Jersey, 2005.

***American Institute of Chemical Engineers (AIChE): *Guidelines for Chemical Process Quantitative Risk Analysis*, Second Edition, New York, 2000.

T. Kletz, *HAZOP & HAZAN. Notes on the Identification and Assessment of Hazards*, Institution of Chemical Engineers, Fourth Edition, UK, 1999.

N. Hyatt, *Guidelines for Process Hazards Analysis, Hazard Identification & Risk Analysis*, Ed. Dyadem Press, Ontario, 2003.

Scientific papers:

1. Zoltán TÖRÖK, Nicolae AJTAI, Adrian T. TURCU, Alexandru OZUNU - Comparative consequence analysis of the BLEVE phenomena in the context on Land Use Planning; Case study: The Feyzin accident, Process Safety and Environmental Protection, 89 (2011) pp. 1-7.
2. TÖRÖK, Z., OZUNU, A., CORDOŞ E., Chemical risk analysis for land-use planning. I. storage and handling of flammable materials, Environmental Engineering and Management Journal, January 2011, Vol.10, No. 1, 81-88.
3. Zoltán TÖRÖK, Alexandru OZUNU, 2010, Chemical risk assessment for storage of hazardous materials in the context of Land Use Planning. AES BIOFLUX 2(1): 33-56

Access places: Central University Library, Libraries of the Faculties of Environmental Science and Engineering, Geography; Chemistry and Chemical Engineering. Electronic library of the Research Center for Disaster Management, Faculty of Environmental Science and Engineering

Legislation:
Regulation (EC) no. 1272/2008 of the European Parliament and of the Council of 16 December 2008 on the classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, as well as amending Regulation (EC) no. 1907/2006, with subsequent amendments and completions
GD no. 539/2016 for the repeal of GD 1408/2008 on the classification, packaging and labelling of dangerous substances and GD 937/2010 on the classification, packaging and labelling of dangerous preparations on the market
Websites:
http://echa.europa.eu/regulations/clp, http://ec.europa.eu/index_ro.htm, http://reach.anpm.ro/ https://www.mmediu.ro/categorie/legislatie/116 www.enviro.ubbcluj.ro, http://www.epa.gov.us, https://minerva.jrc.ec.europa.eu/en/minerva

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Introduction to the topic of practical work	- lecture	2 hours.
2. Prevention of technological accidents	- lecture; - interactive discussions;	2 hours. Examples of accidents. Lessons learned, ways to prevent and mitigate.
3. Study of European and national legislation on the classification of hazardous chemicals.	- lecture; - interactive discussions;	4 hours. Requirements, obligations.
4. Study of the hazardous substances.	- lecture; - interactive discussions;	4 hours. Study of safety data sheets and labelling methods.
5. Preparation of the notification	- Team work	4 hours. Drafting a notification based on legal requirements.
6. Calculation of heat of reaction for hazardous chemical reactions. Calculation of the hazard of the molecule.	- lecture; - interactive discussions;	4 hours. - calculation of the heat of reaction from thermodynamic data and comparison with the acceptable level. - using the CHETAH method to determine the hazard of the molecule.
7. The REHRA method. The hazard index of the installation.	- lecture; - interactive discussions;	4 hours. - calculation of the IHI index for chemical plants

8. Analyses with the FEI method	- lecture; - team work, brainstorming	4 hours. - general description of the method - solving examples in work teams

Bibliography:

Books:

Frank P. Lees: Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, Second edition, United Kingdom, 1996.

Van den Bosch, C. J. H., Weterings R.A.P.M: „Yellow Book": Methods for the Calculation of Physical Effects, Third edition, Committee for the Prevention of Disasters, Netherlands, 1997.

P.A.M. Uijit de Haag, B.J.M. Ale: „Purple Book": Guidelines for Quantitative Risk Assessment, First edition, Committee for the Prevention of Disasters, Hague, 1999.

T. Kletz, *HAZOP & HAZAN. Notes on the Identification and Assessment of Hazards,* Institution of Chemical Engineers, Fourth Edition, UK, 1999.

N. Hyatt, *Guidelines for Process Hazards Analysis, Hazard Identification & Risk Analysis,* Ed. Dyadem Press, Ontario, 2003.

Scientific papers:

1. Zoltán TÖRÖK, Nicolae AJTAI, Adrian T. TURCU, Alexandru OZUNU - Comparative consequence analysis of the BLEVE phenomena in the context on Land Use Planning; Case study: The Feyzin accident, Process Safety and Environmental Protection, 89 (2011) pp. 1-7.

2. TÖRÖK, Z., OZUNU, A., CORDOŞ E., Chemical risk analysis for land-use planning. I. storage and handling of flammable materials, Environmental Engineering and Management Journal, January 2011, Vol.10, No. 1, 81-88.

3. Zoltán TÖRÖK, Alexandru OZUNU, 2010, Chemical risk assessment for storage of hazardous materials in the context of Land Use Planning. AES BIOFLUX 2(1): 33-56

4. Crăciun I., Török Z., Ozunu A., 2015, Comparative analysis of individual risk using different Probit functions in estimating heat radiation consequences, AES BIOFLUX, 7/2, pp. 223-229.

5. Gheorghiu A.-D., Török Z., Ozunu A., Antonioni G., Cozzani V., 2014, Comparative Analysis of Technological and Natech Risk for two Petroleum Products Tanks Located in a Seismic Area, Environmental Engineering and Management Journal, Vol.13/8, pp. 1887-1892.

Legislation:

Regulation (EC) no. 1272/2008 of the European Parliament and of the Council of 16 December 2008 on the classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, as well as amending Regulation (EC) no. 1907/2006, with subsequent amendments and completions

GD no. 539/2016 for the repeal of GD 1408/2008 on the classification, packaging and labelling of dangerous substances and GD 937/2010 on the classification, packaging and labelling of dangerous preparations on the market

Websites:

http://echa.europa.eu/regulations/clp, http://ec.europa.eu/index_ro.htm, http://reach.anpm.ro/ https://www.mmediu.ro/categorie/legislatie/116 www.enviro.ubbcluj.ro, http://www.epa.gov.us, https://minerva.jrc.ec.europa.eu/en/minerva

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 knowledge acquired during the course can be used in the following areas: environmental protection; in process industries: chemical, petro-chemical, pharmaceutical, food, etc.; the academic field;
Graduates can prepare a notification and work in the field of risk analysis and assessment.
Potential employers: environmental agencies, county inspectorates for emergency situations, economic operators with a chemical industrial profile, academic research environment.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Correctness of solving theoretical and practical topics.	Written exam	80%
10.5 Seminar/lab activities	Correctness of solving seminar/laboratory assignments; scientific interpretation of the results; the correctness of the answers given to the questions;	Individual evaluations during seminar/laboratory hours	20%
10.6 Minimum performance standards			
Minimum grade 5 at the Written Exam Minimum attendance of 80% at seminar/laboratory classes.			

Date | Signature of course coordinator | Signature of seminar coordinator

04.12.2024

Date of approval | Signature of the head of department