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	Environmental Engineering
1.5 Study cycle	Master
1.6 Study programme / Qualification	Sustainable Development and Environmental Management

2. Information regarding the course

2.1 Name of the course				**Fire and explosion risk assessment**			
2.2 Course coordinator				**Lect. Dr. Eng. Zoltán Török**			
2.3 Seminar coordinator				**Lect. Dr. Eng. Zoltán Török**			
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Mandatory**

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

3.1 Hours per week	2	Of which: 3.2 course	1	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	28	Of which: 3.5 course	14	3.6 seminar/laboratory	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					44
Additional documentation (in libraries, on electronic platforms, field documentation)					44
Preparation for seminars/labs, homework, papers, portfolios and essays					154
Tutorship					0
Evaluations					4
Other activities:					-

3.7 Total individual study hours	19 x 14 = 266
3.8 Total hours per semester	294
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	Basics of environmental risk assessment procedures, chemistry and mathematics
4.2. competencies	Technical: use of computer software

5. Conditions (if necessary)

5.1. for the course	Necessity of digital projector and computer (laptop)
5.2. for the seminar /lab activities	Laboratory with computers and specific modeling software;

6. Specific competencies acquired

Professional competencies	• Understanding the concepts of technological hazards and risks, related to fire and explosion hazards in the process industries. • Learning to use specific risk analysis methods and software • ATEX zoning for systems with gas and/or dust • Knowing of ATEX marks and equipment.
Transversal competencies	• Ability to conduct literature research in all existing formats; • Knowledge of using specific computer software in the field of environmental studies; • Acquiring knowledge of developing a research project; • Teamwork;

7. Obiectivele disciplinei (reieşind din grila competenţelor acumulate)

7.1 General objective of the discipline	• knowledge of developing a risk study related to fire and explosion in the process industries;
7.2 Specific objective of the discipline	• Knowing the necessities of a fire and risk assessment procedure • Knowledge in theory and practice of fire and explosion risk assessment • Use of methods and techniques for quantitative fire and explosion risk assessment

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction in the prevention of fires and explosions. Definitions and terms. • Fires: types, effects, propagation • Fire hazards of combustible materials	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
2. Explosions. Definitions and terms. • Explosions: types, effects, propagation • Explosion hazards of combustible materials	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
3. Emergency situations involving fires and explosion. Case studies and historical accidents. Lessons learned.	• Interactive exposure • Explanation • Conversation	
4. European and national legislation on fire and explosion prevention. ATEX Directives.	• Interactive exposure • Explanation • Conversation	
5. European and national legislation on fire and explosion prevention. ATEX Directives. ATEX zoning for flammable gas and dust.	• Interactive exposure • Explanation • Conversation	
6. ATEX equipments: - marking styles - temperature classes - protection classes (IP) - equipment classification	• Interactive exposure • Explanation • Conversation	
7. Fire and explosion risk analysis methods and techniques.	• Interactive exposure • Explanation • Conversation	

References:

1. ***American Institute of Chemical Engineers (AIChE), *Guidelines for Chemical Process Quantitative Risk Analysis*, Second Edition, New York, **2000**.
2. 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.
3. 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.
4. S. Mannan, *Lees' Loss Prevention in the Process Industries. Hazard Identification, Assessment and Control*, Elsevier, Third Edition, Oxford, **2005**.
5. H. A. Wray, *Manual on flash point standards and their use: methods and regulations*, Ed. ASTM, Philadelphia, **1992**.
6. R. K. Eckhoff, *Explosion Hazards in the Process Industries*, Ed. Golf Publishing Co., Texas, **2005**.
7. W. P. M. Mercx, A. C. van den Berg, *Vapour cloud explosion. Chapter 5 in C.J.H. Van den Bosch, R.A.P.M. Weterings (eds). Methods for the calculation of physical effects. "Yellow Book"*, Committee for the Prevention of Disasters, VROM, Third Edition, The Netherlands, **2005**.
8. ***American Institute of Chemical Engineers (AIChE), *DOW'S Fire & Explosion Index. Hazard Classification Guide*, Seventh Edition, New York, **1994**.
9. Crăciun I., Lencu V., Calotă S., 1993, *Stabilirea şi prevenirea cauzelor de incendiu,* Ed. Teh.
10. DIRECTIVA 2014/34/UE A PARLAMENTULUI EUROPEAN ȘI A CONSILIULUI din 26 februarie 2014 privind armonizarea legislațiilor statelor membre referitoare la echipamentele și sistemele de protecție destinate utilizării în atmosfere potențial explozive (reformare)
11. ATEX 2014/34/EU Guidelines – Guide to application of Directive 2014/34/EU.
12. EC, 1999, Directive 1999/92/EC of the European Parliament and of the Council of 16 December 1999 on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres (15th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC), Official Journal of the European Communities, published in Official Journal L 23/57 of 28. 1. 2000.
13. Explosion Testing, 2010, www.explosiontesting.co.uk
14. 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.
15. GHEORGHIU A.-D., TÖRÖK Z., OZUNU A., ANTONIONI G., COZZANI V., 2014, Natech Risk Analysis in the Context of Land Use Planning. Case Study: Petroleum Products Storage Tank Farm Next to a Residential Area., Chemical Engineering Transactions, Vol. 36, pp. 439-445.
16. Gheorghiu A.-D., Török Z., Ozunu A., 2013, How Can Existing Risk Assessment Methodologies Be Used in a Systematic Manner, in the Extractive Mining Industry?, Journal of Environmental Protection and Ecology, Vol.14/4, pp. 1597-1607.
17. 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.
18. 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.

8.2 Seminary / laboratory	Teaching methods	Remarks
I. 1. Presentation of the specific topics, important references and the content of the individual projects. 2. Preparation of the project: choosing the technological equipment, definition of	• Interactive exposure • Explanation • Conversation	Content of the project: Selection of the site Definition of the objectives Characterizing the technological process Hazard identification: gases and dusts ATEX zoning

working parameters, environment, and substances.		Fire and explosion risk assessment Results and discussion Conclusions
II. 1. Project development: Effects and consequence analysis for fires.	• Interactive exposure • Explanation • Conversation • Work on computers using modeling tools	Use of EFFECTS modeling tool.
III. 1. Project development: Effects and consequence analysis for explosion.	• Interactive exposure • Explanation • Conversation • Work on computers using modeling tools	Use of EFFECTS modeling tool.
IV. 1. Schemes of territorial risks. 2. Classification of dangerous areas for gases and dusts.	• Interactive exposure • Explanation • Conversation	
V. Project development: ATEX zoning for gases ATEX zoning for dusts	• Interactive exposure • Explanation • Conversation • Group work on drawings	
VI. Project development: - Individual risk analysis - Social risk analysis	• Interactive exposure • Explanation • Conversation • Work on computers using modeling tools	Use of Riskcurves modeling tool.
VII. Colloquy: Presentation of the projects and written exam.	Powerpoint presentations and written exam.	

References:

1. ***American Institute of Chemical Engineers (AIChE), *Guidelines for Chemical Process Quantitative Risk Analysis*, Second Edition, New York, **2000**.
2. 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.
3. P.A.M. Uijt de Haag, B.J.M. Ale: „Purple Book": Guidelines for Quantitative Risk Assessment, First edition, Committee for the Prevention of Disasters, Hague, 1999.
4. S. Mannan, *Lees' Loss Prevention in the Process Industries. Hazard Identification, Assessment and Control*, Elsevier, Third Edition, Oxford, **2005**.
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Directive 89/391/EEC*)*, Official Journal of the European Communities, published in Official Journal L 23/57 of 28. 1. 2000.
13. Explosion Testing, 2010, www.explosiontesting.co.uk
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15. GHEORGHIU A.-D., TÖRÖK Z., OZUNU A., ANTONIONI G., COZZANI V., 2014, Natech Risk Analysis in the Context of Land Use Planning. Case Study: Petroleum Products Storage Tank Farm Next to a Residential Area., Chemical Engineering Transactions, Vol. 36, pp. 439-445.
16. Gheorghiu A.-D., Török Z., Ozunu A., 2013, How Can Existing Risk Assessment Methodologies Be Used in a Systematic Manner, in the Extractive Mining Industry?, Journal of Environmental Protection and Ecology, Vol.14/4, pp. 1597-1607.
17. 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.
18. 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.

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 next domains: environment protection, process industries: chemical, pharmaceutical, petrochemical, food industry etc. and academic domains;
The graduates of this course can contribute in the development of fire and explosion risk studies.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	• Problem solving Correctness of the answers	Colloquy: Questions from theory	50 %
10.5 Seminar/lab activities	Participation at seminar activities Correctness of the results and answers; Scientific presentation of results.	Colloquy: Project	50 %
10.6 Minimum performance standards			
• Minimum grade for promotion of the exam: 5 • Minimum presence at seminar activities: 80%			

Date | Signature of course coordinator | Signature of seminar coordinator

11.04.2018

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