

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	Bachelor
1.6 Study programme / Qualification	Environmental Engineering

2. Information regarding the discipline

2.1 Name of the discipline	Ecotoxicology						
2.2 Course coordinator	Dr. Bocoş-BinţiŃan Victor, Assoc. Prof.						
2.3 Seminar coordinator	Dr. Bocoş-BinţiŃan Victor, Assoc. Prof.						
2.4 Year of study	4	2.5 Semester	8	2.6. Type of evaluation	Coll.	2.7 Regime of the discipline	Optional

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

3.1 Number of hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	48	Of which: 3.5 course	24	3.6 seminar/laboratory	24
Time assignment:					hrs.
Learning using manuals, course support, bibliography and course notes					16
Supplementary documentation in the library, using electronic platforms and in the field					10
Preparation of seminars/laboratories, homework themes, reports, portfolios and essays					6
Tutorship					2
Examinations					2
Other activities:					0
3.7 Total individual study hours		36			
3.8 Total hours per semester		84			
3.9 Number of ECTS credits		4			

4. Prerequisites (when necessary)

4.1 Of curriculum:	Promotion of disciplines from the category of environmental chemistry and physics, biology and ecology, is recommended.
4.2 Of competencies:	- Cognitive competencies: holding basic acquirements from the field of chemistry, biology and ecology. - Action competencies – related to/concerning: information & documentation activities; group activities; argumentation and utilization of information technologies for data acquisition + processing of analytical data; realization of active and critical analyses; operationalization and application of the acquired knowledge. - Affective-attitudinal competencies: availability to imply himself in the didactic process in an active and inter-active manner; availability to design and realize complex experiments.

5. Conditions (when necessary)

5.1 For the course	• Course-dedicated room, which includes a PC, an associated video-projector and a multi-media system.
5.2 For the seminary/laboratory	• Seminar room with PC and video-projector.

6. Specific Competencies acquired

Professional competencies	• Knowing, understanding, analyzing and applying in inter- and trans-disciplinary perspectives, the phenomena and processes related to <u>toxic compounds</u>, to <u>toxicity</u> (and the factors on which it depends), with applicability for protecting the quality of the environment. • Ability to choose pertinent and contextualized methods / techniques of investigation/optimization in accordance with concrete situations and available resources. • Critical evaluation of the toxicity of various classes of chemical pollutants, with emphasis on hazardous/toxic and priority chemical compounds. • Knowledge of the major toxic effects induced on living organisms by the principal categories of toxic substances. • Practical skills necessary to investigate the toxic impact of chemical pollutants through eco-toxicological tests.
Transversal competencies	• Development of actional competencies – information and documentation, group activity, argumentation and use of information technology for both acquisition and processing of toxicological data. • Competence of reflecting (individually and collectively) to various topics and problems. • Practicing cognitive flexibility. • Realization of an efficient communication (verbal, written & electronic). • Active and interactive participation of students to the teaching process in its integrality. • Methodological competencies: taking notes & their systematization, ordering, etc.; formulation of research topics/subjects; enunciation of problem-situations and their solving; establishing hypotheses and verifying them; drafting of texts; relationship with others and empathizing with them; collaboration and group work; involvement in the management of an activity.

7. Objectives of the discipline (based onto the acquired competencies)

7.1 General objective of the discipline	• Acquiring most relevant knowledge related to toxic compounds and to their toxicity in order to be applied to protecting the health of living organisms & of environment.
7.2 Specific objectives	• Applying the basic concepts and principles of toxicology to the main classes of toxic chemical compounds that can be found in the environment. • Indication of the main toxic effects induced by the various categories of toxic compounds – both inorganic (for example: heavy metals and their

	compounds; inorganic gases) and organic (persistent organic pollutants: chlorinated pesticides, polychlorinated biphenyls PCBs, polychlorodibenzodioxins PCDDs; organophosphorus pesticides OPs , polynuclear aromatic hydrocarbons PAHs, etc.). • Knowledge and application of eco-toxicological tests appropriate to various concrete situations that may arise in practice.
--	---

8. Contents

8.1 Course	Teaching methods	Remarks
The course is structured on a set of modules, corresponding to the main themes of the course. These modules have as a common denominator the target of the educational approach, namely: toxic compounds, toxicity, respectively toxic effects – all treated in a systemic manner. CONTENT: C #1. Toxicology, Eco-toxicology & Environmental toxicology – definitions, essential concepts. [2 hours] C #2. Toxicology – The basics of toxicology: exposure and routes of exposure, poisoning, lethal doses, dose-response relationship, scale of acute and relative toxicities. [4 hours] C #3. Toxicity – Indicators of acute toxicity (median lethal dose LD₅₀; minimum lethal dose MLD). Indicators of chronic toxicity (EC₅₀; NOEC; LOEC; NOEL; LOEL; CMA). Biomarkers. [2 hours] C #4. Toxic - The factors on which toxicity depends. Part 1: Exposure factors & body factors. [2 hours] C #5. Toxic - The factors on which toxicity depends. Part 2: Factors related to the toxic compound & factors related to the environment. [2 hours] C #6. Toxicodynamics and toxicokinetics. The effects of toxins at the cellular level. Selective toxicity. Potentiation and synergism. [2 hours] C #7. Toxic - The effects produced on the body. Part 1: Effects on the respiratory, cardiovascular and skin systems. [2 hours] C #8. Toxic - The effects produced on the body. Part 2: Effects on the nervous system, digestive system and endocrine system. [2 hours] C #9. Toxicity – Carcinogenicity and mutagenicity. Classes of carcinogenic compounds; their sources. [2 hours] C #10. Distribution of toxicants in living organisms and ecosystems. Bioconcentration and biomagnification. [2 hours] C #11. Toxins - "Chemical warfare" in the plant kingdom, respectively in the animal kingdom. [2 hours] C #12. Eco-toxicological tests - types, description, use. [2 hours] <i>TOTAL: 24 hours / semester (2 hours / week × 12 weeks).</i>	Interactive lecture Demonstration Problem-based learning Problematization Exercises and problem solving Case studies presentation Heuristic conversation Explication Modeling	Attending the course is facultative, but highly recommended. Attending the applicative activities and seminars is mandatory. Number of absences accepted is maximum 20% of the total number of hours. Students that have a large number of absences at seminars/laboratory cannot attend the final exam. The individual written report is handed to course coordinator <i>before</i> the final exam. Plagiarism results in cancelling the student's written report.

Bibliography:

a) Mandatory Bibliography:

1. Des W. Connell & Greg J. Miller, „*Chemistry and Toxicology of Pollution: Ecological and Human Health*” (Second Edition), 2023, John Wiley & Sons, USA.
2. Colin Harold Walker, „*Organic Pollutants: An Ecotoxicological Perspective*”, 2009, Second Edition, Taylor & Francis CRC Press, Boca Raton, USA.
3. Michael C. Newman and Michael A. Unger, „*Fundamentals of Ecotoxicology*”, 2002, Second Edition, CRC Press, Boca Raton, USA.
4. Helmut Greim and Robert Snyder (editors), „*Toxicology and Risk Assessment: A Comprehensive Introduction*”, 2008, John Wiley & Sons, UK.
5. **Course Support** – Assoc. Prof. Dr. Bocoş-BinţiŃan Victor.

b) Supplementary Bibliography:

6. William C. Clements and Michael C. Newman, „*Community Ecotoxicology*”, 2002, John Wiley & Sons, UK.
7. Laura Robinson and Ian Thorn, „*Toxicology and Ecotoxicology in Chemical Safety Assessment*”, 2005, Blackwell Publishing (CRC Press), UK.
8. Stanley Manahan, „*Environmental Science and Technology*”, 1997, Lewis Publishers, Boca Raton, USA.

8.2 Seminar / laboratory

Content:

- S #1. Toxic effects of heavy metals – Part 1: Lead Pb + mercury Hg + cadmium Cd. [2 hours]
- S #2. The toxic effects of heavy metals – Part 2: Arsenic As + Thallium Tl + Chromium Cr + Nickel Ni. [2 hours]
- S #3. Persistent organic pollutants (POPs). "The Dirty Dozen" - Part 1: Chlorinated pesticides CPs. [2 hours]
- S #4. Persistent organic pollutants (POPs). "The Dirty Dozen" - Part 2: Polychlorinated biphenyls PCBs & polychlorodibenzodioxins PCDDs. [2 hours]
- S #5. Priority organic pollutants – Polycyclic aromatic hydrocarbons PAHs. [2 hours]
- S #6. Organo-phosphorus pesticides (OPs). [2 hours]
- S #7. Super-toxic organophosphorus compounds: Paralyzing chemical weapons (nerve chemical warfare agents). [2 hours]
- S #8. Effects of various classes of toxic compounds on the nervous system and on behavior. [2 hours]
- S #9. Endocrine-disrupting chemicals ("EDCs"). [2 hours]
- S #10. Toxins and their effects. [2 hours]
- S #11. The toxic effects of some food additives. [2 hours]
- S #12. Psychoactive compounds. Illegal drugs and their toxicity. [2 hours]

TOTAL: 24 hours / semester (2 hours/week × 12 weeks).

Teaching
methods

Remarks

Problem-based
learning

Problematizati
on

Exercises and
problem
solving

Heuristic
conversation

Explication

Modeling

Case studies

Bibliography:

Similar to that presented at 8.1.

9. Corroboration of the contents associated to discipline with the expectations of the representatives of epistemic community, professional associations and principal employers acting in the field related to the programme

• The discipline possesses strong inter-disciplinary and trans-disciplinary valences. • The discipline is correlated currently with critical topics worldwide and having a great interest for environmental engineers, such as: detection and quantification of a wide range of pollutants & toxic substances; their processes of (bio)transformation & (bio)degradation; and remediation techniques. • Therefore, this discipline offers the bachelor students the capacity to bring a contribution to solving complex problems related to chemical pollution of the environment, due to the holistic way of approaching the problems associated with the effects of toxic compounds on the health of living species including humans.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the final grade
10.4 Course	Correctness of the answers	Colloquium (written test)	70%
	Capacity to identify problems having a critical status		
10.5 Seminar/laboratory	Capacity to apply the knowledge acquired to concrete situations	Lab written reports / portfolio. Continuous evaluation during the semester.	30%
	Capacity of problem solving and of integrating the acquired knowledge in the discipline with the acquisitions from related disciplines.		
10.6 Minimal standard of performance			
• Knowing the basic notions specific to this discipline and understanding the interdependencies between them. • Application of all mentioned acquisitions to solving problems and practical applications, with different degrees of complexity. Developing students' skills to draw calibration curves and work with them. • Systematic integration of the acquisitions from this discipline with acquisitions characteristic of other disciplines of the bachelor's degree study program.			

Date:

Signature of course coordinator

Signature of seminar coordinator




05.12.2024

Date of approval in the department

Signature of the Head of Department

.....

_____ .