GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2025-2026

## Environmental Risk Assessment (I002606)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 5.0** **Study time 150 h**

**Course offerings and teaching methods in academic year 2025-2026**

| | | | |
|---|---|---|---|
| A (semester 1) | English | Gent | lecture |
| | | | seminar |
| | | | practical |

**Lecturers in academic year 2025-2026**

| | | |
|---|---|---|
| De Schamphelaere, Karel | LA22 | lecturer-in-charge |
| Asselman, Jana | LA22 | co-lecturer |
| Janssen, Colin | LA22 | co-lecturer |
| Verougstraete, Violaine | LA22 | co-lecturer |

| Offered in the following programmes in 2025-2026 | crdts | offering |
|---|---|---|
| Bachelor of Science in Environmental Technology | 5 | A |
| Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation) | 5 | A |
| Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering) | 5 | A |
| Master of Science in Electromechanical Engineering(main subject Maritime Engineering) | 5 | A |
| Master of Science in Electromechanical Engineering(main subject Mechanical Construction) | 5 | A |
| Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering) | 5 | A |
| International Master of Science in Agro- and Environmental Nematology | 5 | A |
| Master of Science in Biology | 5 | A |
| Master of Science in Bioscience Engineering: Environmental Technology | 5 | A |
| Master of Science in Environmental Science and Technology | 5 | A |
| Master of Science in Materials Engineering | 5 | A |
| Master of Science in Sustainable Materials Engineering | 5 | A |
| Exchange Programme in Bioscience Engineering: Environmental Technology (master's level) | 5 | A |

**Teaching languages**

English

**Keywords**

risks and safety of chemicals, environmental toxicology, toxicology, ecotoxicology, toxicity, ecotoxicity tests, risk assessment of chemicals, dose-response evaluation, environmental pollution, human health, effects analysis, exposure analysis

**Position of the course**

The aim of this course is to introduce the students in the theoretical foundations of (eco)toxicology of chemicals and in the principles of exposure, effects and risk assessment of chemicals for ecosystems and humans. A strong focus is on understanding how different physical, chemical, biological and ecological processes contribute to chemicals exposure, effects and, ultimately, risk. Finally, the various aspects of the theory will be brought into practice by means of hands-on training into exposure and effects testing in the laboratory ('practicum') and quantitative (real-life) chemicals risk assessment ('PC exercises', 'case study').

**Contents**

LECTURES

**1.General introduction**

- Chemicals are everywhere… concerns, examples, risks
- The bigger picture: planetary boundaries, sustainable development goals
- The dawn of (eco)toxicology: the case of DDT and effects on bird populations
- What is (Eco)toxicology?
- Human vs. ecological risk assessment
- General scheme of risk assessment: hazard, exposure, effects and risks
- Risk assessment vs. risk management
- Overview of worldwide legislative and regulatory frameworks for chemicals (e.g., REACH,water framework directive)
- Risk characterisation

**2. Environmental Exposure Assessment**

- Emission: sources, scenarios, estimation
- Equilibrium partitioning: principles, examples
- Intra- vs. inter-media transport
- Inter-media transport: sedimentation, leaching (PMT substances), volatilisation
- Transformation of chemicals: general introduction and modeling
- Abiotic degradation: hydrolysis, photolysis
- Biodegradation: persistence, measurement, examples, application (PBT substances)
- External Exposure assessment: predicting concentrations in water, air, soil & sediment
- Internal Exposure assessment: bioconcentration, bioaccumulation, biomagnification; the case of PFOS

**3. (Eco)toxicology at sub-organism level**

- Hierarchical response scales to chemical stress
- Human toxicology and ecotoxicology integration
- Uptake, biotransformation, detoxification and elimination: metals and organic chemicals
- Molecular and cellular effects (oxidative stress, DNA damage, enzyme dysfunction, epigenetic effects)
- Adverse outcome pathways: framework, examples, development, regulatory significance

**4. Ecotoxicology at organism and supra-organism levels and effect assessment**

- Ecotoxicity testing: design, exposure systems, acute and chronic toxicity, data analysis, animal alternatives
- Effect assessment: PNEC derivation, Assesment Factors, Species Sensitivity Distribution
- Contaminants of emerging concern: examples
- Increasing ecological realism: bioavailability and temperature effects, mixture toxicity
- Increasing ecological realism: population, community, and ecosystem-level effects

**5. Human toxicology and risk assessment**

- Introduction, objectives, general framework
- Effects (hazard) assessment: toxicity testing (in vivo, in vitro), epidemiological & other data
- Exposure assessment: occupational, environmental & consumer exposure
- Risk characterisation: comparins exposure with DNEL
- Risk management and communication

**6. Guest lecture(s) on current topic(s) in environmental risk assessment and management**

PRACTICUM (WETLAB)

- Biodegradation test
- Ecotoxicity test

PC EXERCISES (PCLAB)

- Biodegradation and dose-response data analysis
- Environmental exposure & effects assessment and risk characterisation

- Environmental Fate and Bioavailability
- Human exposure & effects assessment and risk characterisation

PC EXERCISES (CASE STUDY)
Students need to search environmental fate, exposure and effects data on a certain chemical, critically review and interpret the dataset & perform a risk assessment.

**Initial competences**

Bachelor of science level knowledge of mathematics, chemistry, biology, and ecology

**Final competences**

1 Understand physical, chemical, biological and ecological processes that determine exposure, effects and risks of chemical to man and the environment
2 Know how theoretical foundations of risk assessment are brought into practice in legislation
3 Apply quantitative techniques for dose-response, exposure, effect and risk evaluation
4 Interpret, critically analyze and report on scientific literature on (eco)toxicology and risk assessment

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Seminar, Lecture, Practical

**Study material**

Type: Syllabus

Name: Environmental Risk Assessment - Practicum
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available through Student Association : No

Type: Slides

Name: Environmental Risk Assessment
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

Type: Audiovisual Material

Name: Environmental Risk Assessment
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime after the Study Programme : not

Type: Lab Material

Name: Environmental Risk Assessment
Indicative price: Free or paid by faculty
Optional: no

Available through Student Association : No
Usability and Lifetime within the Course Unit : one-time

**References**

van Leeuwen C.J., Vermeire T.G. (2007) Risk Assessment of Chemicals: An Introduction. Springer, 2nd edition, 688p; ISBN 978-1-4020-6101-1.

**Course content-related study coaching**

Lecturers and academic assistants can be consulted (after electronic appointment only) for additional guidance

**Assessment moments**

end-of-term assessment

**Examination methods in case of periodic assessment during the first examination period**

Skills test, Written assessment with multiple-choice questions

**Examination methods in case of periodic assessment during the second examination period**

Skills test, Written assessment with multiple-choice questions

**Examination methods in case of permanent assessment**

**Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible

**Extra information on the examination methods**

**Period-aligned evaluation (during examination period):**

• Theory: closed book exam with multiple choice questions focusing on a detailed and integrated understanding of the theoretical foundations of (eco)toxicology and risk assessment.
• Skills test: closed book exam; students will need to solve one or more 'integrated problems' for which integrated knowledge obtained during the lectures, practicals and PC exercises classes is required

**Calculation of the examination mark**

The calculation of the global examination mark will be as follows:
1. Theory: 50% of the total mark (10 points of the 20)
2. Skills test: 50% of the total mark (10 points of the 20)

Students who eschew period eschew participation in practicum, PC exercises, or case study may only be able to receive a global examination mark of 6/20.