UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Laboratory of Biological Quality Analysis

2627-3-E3201Q112

Aims

The course provides theoretical and practical knowledge for the evaluation of biological quality in aquatic environments, with particular reference to the presence of potentially dangerous compounds and pathogenic microorganisms.
The theoretical and practical methods provided in the course are aimed at an immediate job placement or preparatory for master's studies. In particular, the most frequently used procedures in the toxicological and microbiological analysis of surface water, urban and industrial wastewater are deepened.
The provided notions will be framed in the regulatory framework of the Consolidated Environmental Act 152/2006 and subsequent amendments.

1. **Knowledge and understanding** . At the end of the course the student will have to know: the methods of assessing the quality of water from an eco-toxicological and microbiological point of view; the main international and national standard tests, framed in current legislation; the methods used for work in infertility; the main cellular models for the evaluation of toxic effects on humans.
2. **Ability to apply knowledge and understanding** . The student must be able to apply the knowledge acquired in the frontal part of the teaching demonstrating that they are able to carry out the toxicological and microbiological tests learned in the laboratory. Furthermore, at the end of the course, the student must be able to describe how to calculate the dose-response curves for the evaluation of toxicity effects.
3. **Autonomy of judgment** . The student should be able to evaluate the biological quality of an aqueous matrix by examining the results of specific tests conducted on a water sample.
4. **Communication skills**. At the end of the course the student will be able to describe in an appropriate way the topics studied using the correct specific vocabulary.
5. **Learning skills**. At the end of the course the student will be able to consult the literature on the topics covered and the reference legislation. He will also be able to independently design a protocol for analyzing the biological quality of a water sample.

Contents

Analysis of the biological quality of surface, wastewater and drinking water by means of toxicological and microbiological tests.
Analysis of the biological quality of surface, wastewater and soil by means of ecotoxicological tests.

Detailed program

The course will be divided into lectures, exercises and multidisciplinary laboratories.
During lectures the basic notions will be introduced regarding:
• acute and chronic toxicological tests
• description of the main toxicological tests on aquatic organisms (*Daphnia magna, Ceriodaphnia dubia, Selenastrum capricornutum, Aliivibrio fischeri, Artemia salina, Danio rerio*)
• the concept of dose/response
• introduction to cellular models for the evaluation of effects on humans (hepatocytes and monocytes)
• description of toxicological tests relevant to human impacts (activation of cytochromes and release of inflammatory mediators)
• analysis of the contents of international standard tests (OECD)
• toxicological endpoints (EC50, EC10, LOEC, NOEC)
• the concept of sterility while working with microorganisms
• microbiology culture media.

**Laboratories **

The student will learn methods for:
• the quantification of total bacteria, faecal coliforms and other microbiological indicators of fecal contamination;
• the characterization and identification of microorganisms, with particular reference to bacteria of fecal origin, through biochemical tests (staining and observation under a microscope, enzymatic tests, tests for the identification of coliforms);
• DNA extraction from environmental samples;
• the use of PCR in the microbiological field for the analysis of taxonomic markers and the search for pathogens;
• the application of standard tests (OECD and ISO protocols) for the evaluation of toxicity on aquatic and multicellular organisms and on in vitro models, will be conducted or toxicological tests with *D. magna* and *A. fischeri* on waste and/or surface water,
• biochemical analysis for the evaluation of potential effects on humans (extraction and quantification of proteins and activation of cytochromes).
• the application of standardised tests (ISO 11267:2023), which enable the measurement of soil habitat function by assessing whether pollutants or disturbances hinder the survival and reproduction (sublethal effects) of *F. candida*.
• the application of standardised tests (ISO ISO 18763), which enable s the use of *Sinapis alba* (white mustard) or *Lepidium savitum* as a standard testing organism for ecotoxicological assessments. These tests measure the germination rate and root elongation of the plant to evaluate the toxicity of soils, sediments, and chemical pollutants.

Tutorials on:
• basic statistical techniques for the calculation of dose-response curves and effect concentrations (LC50, LC10, EC50, EC10, IC50 and IC10).

Prerequisites

No basic skills required

Teaching form

The course is composed of:
a) 6 two-hour lectures, in person, Delivered Didactics;
b) 1 two-hour lecture, in person, Interactive Teaching;
c) 7 four-hour lab activities, in person, Interactive Teaching;
d) 2 three-hour lab activities, in person, Interactive Teaching;
e) 1 four-hour practical class, in person, Interactive Teaching;
f) 1 three-hour practical class, in person, Interactive Teaching;
g) 1 two-hour practical class, in person, Interactive Teaching.
All types of didactic delivery are supervised by the lecturer.

Textbook and teaching resource

Slides (available on e-learning); additional material provided by the teachers

Semester

Second semester

Assessment method

Oral examination at the end of the course, ON THE TOPICS COVERED IN THE LECTURES.
There will be NO in-class tests. Oral exam at the end of the course.
The evaluation criteria that the examination board will use to evaluate learning consist in the direct verification of the acquisition by the student of the topics covered during the lectures and related to the program carried out in the laboratories and exercises.
The questions will aim to ascertain the acquisition of basic skills and to evaluate the understanding of the concepts and technical / practical methods addressed in the laboratories, the ability to connect the different topics covered.

There are no intermediate tests.
Mark range: 18-30/30

Office hours

by appointment, sending an email to sara.villa@unimib.it, isabella.gandolfi@unimib.it or maurizio.gualtieri@unimib.it

Sustainable Development Goals

CLEAN WATER AND SANITATION | LIFE ON LAND