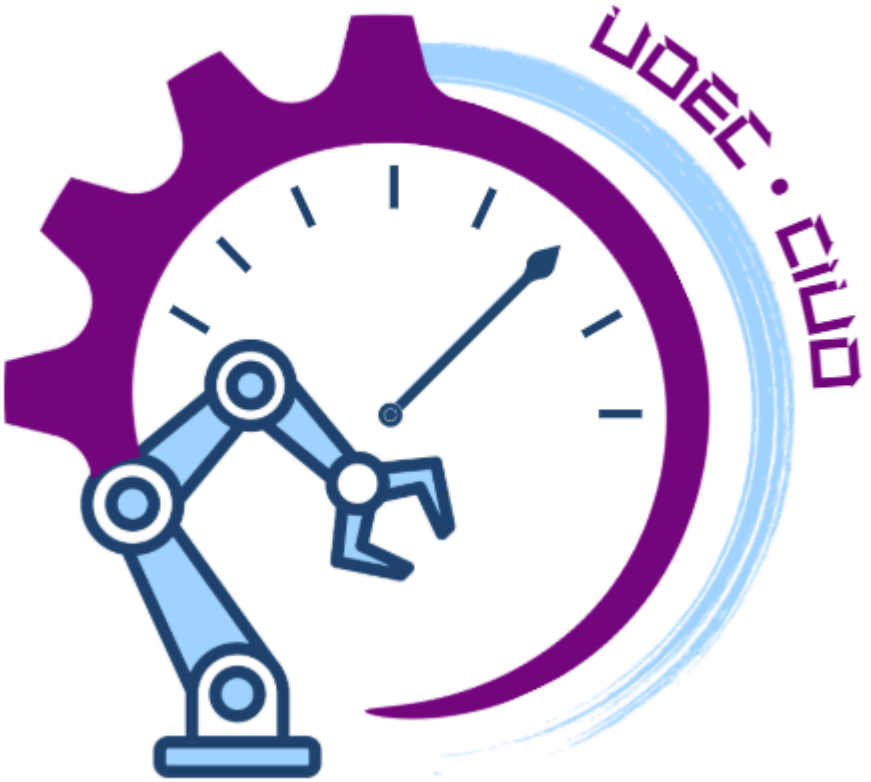


Université d'Ottawa D'OTTAWA

CONCOURS D'INGÉNIERIE

Concours de bio-ingénierie 2026

Association des étudiants en génie de l'Université d'Ottawa

VP Affaires Internes

competition@uottawaess.ca

This document outlines requirements and expectations for competitors in the Bio-Engineering category at uOEC 2026. Please read this document carefully and in full.

Overview

Competitors must develop a comprehensive approach to a bio-engineering problem. The goal is to identify the issues outlined in the prompt and develop a bio-engineering design process to solve them for various applications in healthcare, agriculture, environmental sustainability, and more.

Scenario

Background
Algal blooms on freshwater lakes and rivers affect not just the health of the ecosystem but also the homes, businesses, and organizations that depend on them for raw water as well as for recreational and aesthetic purposes. Algal blooms are any large-scale growth of algae, which is typically eukaryotic or cyanobacteria (sometimes known as “blue-green algae”). [1][2]

What causes algal blooms?
High levels of phosphorus in water, caused mainly by fertilizer runoff from agricultural land but also by wastewater from sewage treatment plants and urban stormwater runoff, have been recognized as a major cause of algal blooms, as phosphorus is required for all plant growth. Climate change further accelerates bloom frequency severity; elevated water temperatures enhance cell division and metabolic rate in algae. [1][2]

Effect on environment and human health
The problem with algal blooms has multiple aspects. Planktonic blooms dominated by cyanobacteria may create toxins, such as microcystins, which can be dangerous and even lethal to humans, livestock, pets, birds, fish, and other animals. Non-toxic blooms are also a concern. Green algae, such as Cladophora, frequently pollute the shore of freshwater lakes with dense, decaying algal layers that can clog municipal and industrial water intakes, affect water quality and inshore habitat, and create health concerns for wildlife and humans.[2]

Lake Erie experiences some of the most frequent and severe harmful algal blooms among North American freshwater bodies. Reports showed that long-term costs imposed on ecological goods and services due to the blooms that affect the lake are expected to reach $272 million annually if left unchecked. Tourism operators ($110 million annually costs) and recreational users who value the lake for its inherent value ($115 million annually costs) were determined to carry the highest costs. [3]

Objective

This is where you as bio-engineers come in; the Ontario government has tasked you with a special mission: Create a scalable, closed-loop process that could be deployed to harvest harmful algae from contaminated freshwater sources, while maximizing the potential of conversion of recovered wet biomass into viable commercial co-products and minimizing process waste. Due to the dangerous toxins produced by algae, the co-product selection must account for toxin degradation.

Rules and Constraints

The maximum number of individuals for a Bio-Engineering team is two (2).
Internet use is permitted during the competition for research and preparation.
Your bio-engineering solutions are encouraged to apply different engineering disciplines (electrical, mechanical, chemical, etc.) but must include biological concepts, living organisms or biomaterials alongside with the solution.
Your team is tasked with designing a solution for the Ontario government. The design report and presentation should also address these topics:

1. Social & Public Health Impacts:
    - Direct and indirect health impacts.
    - Process with government standard (e.g., Health Canada or Ontario Ministry of Health).
    - Explicitly account for toxin degradation of co-product

2. Environmental Sustainability:
    - Toxin management and safe handling of recovered biomass.
    - Waste management, biomass degradation pathway, and disposal protocol.
    - Net carbon/environmental footprint and long-term ecology effects.

3. Technical Feasibility:
    - Step-by-step procedures that could be followed immediately after presentation
    - Scientific research with sources to support the procedures
    - Statements underlying physical and biological assumptions
    - Clear flow chart or visual schematic to describe the systems, outline input, output, and biological reactions.

4. Risk Analysis & Assumptions:
    - Technical, biological and operational limitations
    - Potential failures and possible solutions to it

Your team's design and organizational approach to achieving these objectives is left to your discretion. Teams are expected to develop a technically justified conceptual design, rather than a fully engineered implementation. A full solution to the problem is not required, but you will be assessed on how you approach the problem and how your team would solve it given a larger timeline and resources.

Durations:

- Design duration is from 8:30 am to 12:00 pm.
- Teams must submit their reports and presentations by 12:00 pm or late penalty will be applied.
- Judging duration starts at 1:00 pm
    - Presentations will be randomized and announced 30 minutes before judging.
    - Presentation Duration: six (6) to eight (8) minutes maximum.

- Question Period Duration: three (3) minutes maximum.

Deliverables

You are required to submit to the VP Internal, before the end of the design period, the following:
a. Report: A design proposal report from four to six (4-6) pages (not including appendices and references) detailing your proposed solution. The report will be made available to the judges before each team's presentation. The report must contain the following:

- Front matter, including a title page, table of contents and an abstract (maximum 250 words)
- Introduction to the topic and its context
- The body of the report must address the points outlined in the scenario above in a clear, organized manner (appropriate use of headings is recommended)
- Design are explained using appropriate amount of technical terms that are clearly defined
- Conclusion must summarize the main findings and outline future recommendations
- All research conducted must be properly cited (choice of citation style will be left to your discretion but must be consistent) and figures formatted appropriately.
- Everything counted toward your page requirement except references and appendices

Refer to engineering reports done in your courses and/or engineering journals for specific guidance on formatting and writing style.

b. Presentation: A file containing your presentation on your proposed solution. Your presentation should follow the structure of your report and highlight the most important aspects of your solution and findings. Appropriate use of visual aids should enhance your points. Remember that your goal is to convince the judges/clients that your solution is feasible, innovative and well-rounded.

These submissions must be made to the VP Internal before your competition time elapses by email, internal@uottawaess.ca. Please note that this is a hard submission deadline, and if your submission is not received by then, your team will be heavily penalized (refer to the rubric). Volunteers will be around counting down the time and reminding you to make your submission.

Refer to the judging rubric (provided below) for criteria to keep in mind when designing your solution and what the judges will be looking for.

Judging and Scoring

For your reference, the judging matrix is provided below.

Solution (60)	Deliverable Compliance with Expectations	5
	Technical Feasibility	20
	Environmental Consideration	10
	Social & Health Impact	20
	Risk Analysis	5
Report (15)	Clarity	5
	Writing Style & Professionalism	5
	Design Justification	5
Presentation (25)	Voice	5

	Articulation and Timing	10
	Visual Aids	5
	Response to Questions	5
Penalties	Plagiarism	-50
	Insufficient Citation	-50
	Documents Received After Deadline	-50
	Absent Team Member	-25
Total		/ 100

Refer to the uOEC 2026 rulebook for general rules. Where this package and the rulebook differ, this package takes precedence.

References

[1]. https://www.sciencedirect.com/science/article/pii/S0380133026001164#kg005
[2]. https://www.niehs.nih.gov/health/topics/agents/algal-blooms
[3]. https://hero.epa.gov/reference/5528187/