ORIGINAL COURSE IMPLEMENTATION DATE:	January 2014
REVISED COURSE IMPLEMENTATION DATE:	September 2022
COURSE TO BE REVIEWED (six years after UEC approval)**:**	January 2028

Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: BIO 426

Number of Credits: 4 Course credit policy (105)

Course Full Title: Environmental Microbiology

Course Short Title:

(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science

Department (or program if no department): Biology

Calendar Description:

An examination of pathogenesis, pollution remediation, energy conservation, and the symbiotic relationships between microorganisms and higher organisms which are important to life. This course will use an interdisciplinary approach to study the physiology, ecology, biochemistry, and genetics of microorganisms as they interface with us and our environment, including soil, aquatics, and the atmosphere.

Prerequisites (or NONE): BIO 201 and BIO 309.

Corequisites (if applicable, or NONE):

Pre/corequisites (if applicable, or NONE):

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number: **BIO 326**

Cross-listed with:

Dual-listed with:

Equivalent course(s): *(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)*

Typical Structure of Instructional Hours

Lecture/seminar hours	45
Tutorials/workshops	
Supervised laboratory hours	45
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**90**

Labs to be scheduled independent of lecture hours: ☐ No ☒ Yes

Special Topics *(Double-click on boxes to select.)*

This course is offered with different topics:

☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study

If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*

☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit

Transfer credit already exists: *(See **bctransferguide.ca**.)*

☒ No ☐ Yes

Submit outline for (re)articulation:

☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System

☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 24

Expected Frequency of Course Offerings:

Every other year *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Gregory Schmaltz	**Date approved:**	September 2021
Faculty Council approval	**Date approved:**	October 8, 2021
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	January 28, 2022

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Discuss sustainability issues relevant to the ongoing pollution of our environment.
2. Describe the differences between water and soil habitat and their influences on microbial activities.
3. Understand the importance of chemical structure of molecules and how this results in their retention by the environment, and their degradation by microorganisms.
4. Explain the role of chemical structure on biodegradation using specific examples of naturally occurring compounds, including various hydrocarbons and pesticides.
5. Analyze the roles of microorganisms in groundwater and soil ecosystems, especially in terms of their effects on the evolution of the biogeochemistry and biochemical properties of these systems.
6. Relate the microbiology of groundwater to the observed changes in naturally occurring compounds introduced into groundwater.
7. Describe the basic principles of bioremediation activities as they are used in contaminated soil and groundwater.
8. Devise appropriate generalized systems to perform bioremediation in contaminated systems.
9. Evaluate bioremediation processes and applications in environmental sustainability.
10. Design a laboratory project relevant to bioremediation and environmental sustainability.
11. Perform a laboratory project showing how bioremediation is capable of maintaining environmental sustainability
12. Explain the importance of genetic engineering to the future of environmental sustainability.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lectures, laboratories, field trips.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Pepper E L, Gerba CP, Gentry CJ	Environmental Microbiology	☒	Elsevier	2014
2.			☐		

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Lab coat.

Typical Evaluation Methods and Weighting

Final exam:	35%	Assignments and quizzes:	10%	Field experience:	%	Portfolio:	%
Midterm exam:	25%	Project:	%	Practicum:	%	Laboratory reports/project:	20%
Quizzes/tests:	%	Lab quizzes:	10%	Shop work:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

- Review of basic microbiological concepts
  - Introduction to environmental microbiology; microorganisms; bacterial growth
- Microbial environments, including the soil, aquatic, and the atmosphere.
- Detection, enumeration, and identification
  - Environmental sample collection and processing; Microscopic techniques; Cultural methods; Physiological
  - methods; Immunological methods; Nucleic acid-based methods of analysis
- Microbial communication, activities, and interactions with environment and nutrient cycling
  - Biogeochemical cycling; Consequences of biogeochemical cycles gone wild; Microbial communication:
  - Bacteria/bacteria and Bacteria/host; Bacterial communities in natural ecosystems; Global change and microbial
  - infectious disease; Microbial transport
- Remediation of pollutants
  - Microorganisms and organic pollutants; Microorganisms and metal pollutants; Genetics of bioremediation and its
  - application to biotechnology
- Water, soil, and food-borne pathogens
  - Environmentally transmitted pathogens; Indicator microorganisms
- Waste treatment and disinfection
  - Wastewater treatment and biosolids reuse; Drinking water treatment; Disinfection, Subsurface microbial processes
- Environmental Sustainability
  - Introduction to environmental sustainability issues including but not limited to protection of agricultural soil,
  - Development of renewable energy resources, and water quality.

- Urban microbiology
    - Microorganisms and bioterrorism; Risk assessment, Specific examples e.g., the Walkerton incident.

Laboratory:

- Examination of soil microorganisms via microscopic and cultural assays/filamentous fungi
- Degradation of hydrocarbons/bioremediation/[pseudomonas enrichments
- Coliforms (MPN and Membrane Filtration) (Confirmed test) (Completed test)
- Microbial transformations and response to contaminants/ Nitrification and denitrification
- Aerobiology: Sampling of airborne microorganisms
- Soil enzymes/dehydrogenase activity
- Bioremediation projects (including molecular biology of hydrocarbon degradation)