

OCES 4201 Environmental Microbiology (3 credits)

Instructor: Prof. Qinglu Zeng, Department of Ocean Science, HKUST

Class schedule: 4:30 pm to 5:50 pm, Tuesdays and Thursdays

Venue: Room 5402

Office hours: By appointment

Office: Room 5003, 5th floor, the CYT Building

Tel: 2358 8701 **Email:** zeng@ust.hk

Course description

The objective of this course is to acquaint students with (i) the essential characteristics of microorganisms in the environment, (ii) how microorganisms contribute to ecological processes that shape our ecosystem, and (iii) how microorganisms are employed in environmental biotechnology. By examining real-world examples and case studies, students will develop a comprehensive grasp of crucial ideas and their real-world uses.

Course intended learning outcomes

By the end of this course, you will be able to:

1. Appreciate the vast diversity of microorganisms in the natural environment;
2. Understand the relationship between environmental conditions and the genetic, functional, and morphological diversity of microorganisms;
3. Explain the key ecological processes that are driven by environmental microorganisms;
4. Apply microbiological principles to explain the underlying mechanisms of various environmental technologies.

Learning materials

Major references:

- Environmental microbiology: fundamentals and applications
- Prescott's Microbiology, by Willey, Sherwood and Woolverton, 9th edition, 2014

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation. Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Assessment Task	Contribution to Overall Course Grade (%)	Due Date
Mid-term examination	25%	Oct 9 2026
Lab report	20%	Nov 25 2026
Presentation	20%	Nov 27 2026
Final examination	25%	To be announced
Attendance	10%	NA

Mapping of course ILOs to assessment tasks

Assessed Task	Mapped ILOs	Explanation
Mid-term examination	ILO2, ILO3, ILO4	This task assesses students' ability to understand the basic concepts (ILO 2), explain the ecological functions of microorganisms (ILO 3), and apply microbiology to solve environmental problems (ILO 4).
Project report	ILO1	This task assesses students' ability to study the diversity of microorganisms (ILO 1).
Presentation	ILO4	This task assesses students' ability to apply microbiology to solve environmental problems (ILO4).
Final examination	ILO2, ILO3, ILO4	This task assesses students' ability to understand the basic concepts (ILO 2), explain the ecological functions of microorganisms (ILO 3), and apply microbiology to solve environmental problems (ILO 4).

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have questions about the marks should consult the instructor within five working days after the feedback is received.

Course AI Policy

The use of Generative AI in assessment tasks is permitted. However, you must declare its use. Using generative AI without declaration will be considered as academic misconduct.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy ([URL]). All submissions will be scanned using anti-plagiarism software. Suspected and confirmed cases of plagiarism will be handled in accordance with university policy.

Final grade descriptor

Grades	Short description	Elaborate on subject grading description
A	Excellent performance	Exhibits an exceptional grasp of the vast diversity of microorganisms in natural environments and their genetic, functional, and morphological variations in response to environmental conditions. Demonstrates an outstanding ability to explain complex ecological processes driven by microbes and apply microbiological principles to elucidate the mechanisms underlying various environmental technologies. Exemplary critical thinking and problem-solving skills.
B	Good performance	Demonstrates a strong understanding of microbial diversity in nature and the relationship between environmental factors and microbial characteristics. Proficiently explains key ecological processes mediated by microbes and applies microbiological concepts to environmental technologies. Good critical thinking and analytical abilities.
C	Satisfactory performance	Displays a satisfactory level of comprehension of microbial diversity, the interplay between environmental conditions and microbial traits, microbially-driven ecological processes, and microbiological principles in environmental technologies. Reasonable critical thinking and problem-solving skills.
D	Marginal Pass	Exhibits a basic grasp of microbial diversity, the influence of environmental conditions on microbes, and ecological processes involving microbes. Limited ability to apply microbiological concepts to environmental technologies. Marginal critical thinking and problem-solving proficiency.
F	Fail	Lacks fundamental understanding of the course concepts regarding microbial diversity, the role of environmental factors, key ecological processes, and the application of microbiological principles to environmental technologies. Insufficient critical thinking and problem-solving abilities.

Course calendar

Date	Topic
September 2	Introduction to microbiology
September 4	Bacterial cell structure (I)
September 9	Bacterial cell structure (II)
September 11	Bacterial and archaeal cell structures
September 16	Viruses
September 18	Microbial growth
September 23	Microbial metabolism
September 25	Microbial taxonomy
September 30	Origin of microbial life
October 2	Microorganisms in aquatic ecosystems
October 7	Holiday
October 9	Mid-term exam
October 14	Microorganisms in terrestrial ecosystems
October 16	The extreme conditions of life on the planet and exobiology
October 21	Marine microbial community structure
October 23	Horizontal gene transfer in microbial ecosystems
October 28	Applied microbial ecology and bioremediation
October 30	Methods for studying microorganisms in the environment
November 4	Functional genomics
November 6	Modeling in microbial ecology
November 11	Lab experience on bacterial growth
November 13	Lab experience on bacterial growth
November 18	Lab experience on phage growth
November 20	Lab experience on phage growth
November 25	Group presentation
November 27	Group presentation