國立中正大學課程大綱

National Chung Cheng University Syllabus

課號 Course Code	2708019	**全英文授課 EMI**	**☑是(Y)　☐否(N)**
課程類別 Course Type	**☐人文關懷課程　☐競賽專題課程　☑問題導向課程 ☑專題導向課程　☑總整課程　☐實作課程 ☐實習　☐其他**		
課程名稱（中文） Course Name (zh)	高等環境微生物學		
課程名稱（英文） Course Name (en)	Advanced Environmental Microbiology		
學年/學期 Academic Year / Semester	114/1	**學分 Credits**	3
學系（所） Department	地環所 STEM	**必選修 Required / Selected**	**☐必修　☑選修**
上課時間 Class Hours	Wed. 3, 4, 5 09:10~12:00	**上課地點 Classroom**	地震館 R102
教師 Instructor	許昺慕	**教師 email Instructor’s email**	bmhsu@ccu.edu.tw
助教 Teaching Assistant		**助教 email TA’s email**	
先修科目或 先備能力 Prerequisites			
課程概述 Course Descriptions	This course explores the diversity, ecology, and methodologies of environmental microbiology at an advanced level. Students will examine microbial interactions with Earth’s environments, growth dynamics, and cutting-edge techniques for studying microorganisms. Each thematic unit culminates in a student-led presentation of a topical paper.		
學習目標 Learning Objectives	1. Understand the diversity and ecological roles of environmental microorganisms. 2. Analyze microbial growth and adaptations across varied environments. 3. Evaluate and apply advanced techniques for studying environmental microbes. 4. Synthesize and present complex research findings effectively.		
教科書及參考書 Textbooks and References	Environmental Microbiology (Third edition) ISBN: 978-0-12-394626-3		

教學要點概述				
教材編選 Teaching Materials	☑自製簡報(ppt) ☐教學程式	☑課程講義 ☐自製教學影片	☐自編教科書 ☐其他	
教學方法 Teaching Methods	☑講述 ☑個案研究	☐小組討論 ☐其他	☑學生口頭報告	☑問題導向學習
評量工具 Evaluation Tools	☐期中考 ☑課後作業 ☐評量尺規	☐期末考 ☑期中報告 ☐其他	☐隨堂測驗 ☑期末報告	☐隨堂作業 ☑專題報告
教學資源 Teaching Resources	☐課程網站	☑教材電子檔供下載	☐實習網站	
教師 相關訊息 Instructor’s Information				
每週課程內容 Weekly Scheduled Contents				

Course Title: Advanced Environmental Microbiology

Level: Doctoral

Duration: 16 weeks

Overview: This course explores the diversity, ecology, and methodologies of environmental microbiology at an advanced level. Students will examine microbial interactions with Earth’s environments, growth dynamics, and cutting-edge techniques for studying microorganisms. Each thematic unit culminates in a student-led presentation of a topical paper.

Syllabus Outline

Theme 1: Foundations of Environmental Microbiology

Weeks 1–4

Objective: Establish the foundational principles of environmental microbiology, including microbial diversity and key Earth environments.

- **Week 1: Introduction to Environmental Microbiology**
  - Overview of environmental microbiology: scope and significance
  - Historical perspectives and current challenges
  - Microbial roles in ecosystems

- **Week 2: Microorganisms Found in the Environment**
    - Taxonomy and diversity of environmental microbes (bacteria, archaea, fungi, viruses)
    - Ecological niches and adaptations
    - Case studies of key environmental microorganisms
- **Week 3: Earth Environments**
    - Microbial habitats: terrestrial, aquatic, and atmospheric systems
    - Biogeochemical cycles and microbial contributions
    - Interactions between microbes and abiotic factors
- **Week 4: Student Topical Paper Presentations**
    - Students present research papers related to foundational concepts in environmental microbiology
    - Peer discussion and critique

Theme 2: Microbial Dynamics and Growth

Weeks 5–8
Objective: Investigate bacterial growth and microbial ecology across diverse environmental contexts.

- **Week 5: Bacterial Growth**
    - Growth kinetics and environmental influences
    - Batch and continuous culture systems
    - Quorum sensing and population dynamics
- **Week 6: Aeromicrobiology**
    - Microbes in the atmosphere: dispersal, survival, and deposition
    - Bioaerosols and their environmental impact
    - Methods for studying airborne microorganisms
- **Week 7: Aquatic Environments**
    - Microbial ecology of freshwater, marine, and brackish systems
    - Nutrient cycling and microbial metabolism in water
    - Biofilms and their ecological roles
- **Week 8: Student Topical Paper Presentations**
    - Students present research papers on microbial growth or ecology in specific environments
    - Peer discussion and critique

Theme 3: Extreme Environments and Microbial Adaptations

Weeks 9–12

Objective: Explore microbial life in extreme conditions and the physiological adaptations that enable survival.

- **Week 9: Extreme Environments**
  - Types of extreme environments (e.g., high temperature, salinity, pH, pressure)
  - Extremophiles: diversity and adaptations
  - Biotechnological applications of extremophiles
- **Week 10: Physiological Methods**
  - Techniques for studying microbial physiology in extreme conditions
  - Metabolic pathways and stress responses
  - Experimental design for physiological studies
- **Week 11: Environmental Sample Collection and Processing**
  - Sampling strategies for extreme environments
  - Preservation and processing of environmental samples
  - Challenges in studying low-biomass or inaccessible habitats
- **Week 12: Student Topical Paper Presentations**
  - Students present research papers on extremophiles or physiological adaptations
  - Peer discussion and critique

Theme 4: Advanced Techniques in Environmental Microbiology

Weeks 13–16

Objective: Master advanced methodologies for studying environmental microorganisms.

- **Week 13: Microscopic Techniques**
  - Advanced microscopy: fluorescence, electron, and confocal techniques
  - Visualization of environmental microbes and their interactions
  - Limitations and innovations in microscopic analysis
- **Week 14: Cultural Methods**
  - Cultivation of environmental microbes: selective and enrichment techniques
  - Challenges in culturing unculturable microorganisms
  - High-throughput culturing approaches
- **Week 15: Immunological Methods**

    - Antibody-based detection and identification of microbes
    - Applications in environmental monitoring and pathogen detection
    - Integration with other molecular techniques
- **Week 16: Student Topical Paper Presentations**
    - Students present research papers on advanced techniques in environmental microbiology
    - Peer discussion and critique

Course Requirements

- **Participation:** Active engagement in discussions and critiques (20%)
- **Weekly Readings:** Critical analysis of assigned journal articles (20%)
- **Topical Paper Presentations:** Four presentations, one per theme (40%)
- **Final Project:** A comprehensive review paper or research proposal on an environmental microbiology topic (20%)

Learning Outcomes

By the end of the course, students will:

1. Understand the diversity and ecological roles of environmental microorganisms.
2. Analyze microbial growth and adaptations across varied environments.
3. Evaluate and apply advanced techniques for studying environmental microbes.
4. Synthesize and present complex research findings effectively.
