

Module Code	CEU11E13
Module Name	Biology for Environmental Engineering
ECTS Weighting¹	5 ECTS
Semester taught	Semester 2
Module Coordinator/s	Muhammad Ali
<u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Provide an account of the cellular basis of life: from its origins in the abiotic world, to the evolution of unicellular and multicellular organisms.</p> <p>LO2. Describe the diversity of life forms: including viruses, Prokaryotes (bacteria), Archaea, and Eukaryotes (unicellular organisms, animals and plants).</p> <p>LO3. Differentiate microorganisms according to their metabolism (e.g., electron acceptors, electron donors and carbon source).</p> <p>LO3. Employ a range of laboratory techniques, demonstrating the development of practical scientific skills, knowledge of experimental design and the interpretation of results.</p> <p>LO4. Apply the scientific method as a fundamental approach to experiment-based investigations, critical analysis of data, and problem solving.</p> <p>LO5. Outline the diversity of life on earth and describe how it evolved over geological time scales.</p> <p>LO6. Describe the ecological relationships between microbial communities and ecosystems.</p> <p>LO7. Explain how microorganism can positively and negatively influence other living organisms and their environment and understand the value of microorganisms for humans.</p> <p>LO8. Collate, synthesise, organise and present information in written reports.</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Introduced</p> <p>To think independently - Introduced</p> <p>To develop continuously - Introduced</p> <p>To communicate effectively - Not embedded</p>

¹ [TEP Glossary](#)

Module Content

This module aims to provide an introduction to microbiology with relevance to both the natural and engineered systems. It starts with a description of the possible origin of life, from the abiotic world to single-celled and multicellular organisms, and the ultrastructure of the prokaryotic and eukaryotic cells will be covered in detail. The diversity of life forms, from viruses to prokaryotic and eukaryotic microorganisms will be described. This course will serve as an introduction to the topic of environmental microbiology. Information about basic microbiology and biochemistry, and microbial ecology will be incorporated, providing the student with both an understanding of basic microbiology and of the potential of microorganisms to influence our environment. The topics addressed in the course include:

1. Introduction to microbiology
Microbiology & Microorganisms; Hallmarks of cellular life; Cell structure; Microorganisms and the Biosphere; The Impact of Microorganisms on Human; Microscopy and the Origins of Microbiology
2. Classification of microorganisms
Classification based on: Cell Morphology, Nutrients requirement; Environmental requirements; Phylogeny; Metabolic Diversity
3. Microbial cell structure and function
Size of Microbes; The Cytoplasmic Membrane; Transporting Nutrients into the Cell; Cell Motility; Chemotaxis and Other Taxes
4. Microbial metabolism
Feeding the Microbe: Cell Nutrition; Culture Media; Principles of Bioenergetics; Electron Donors and Acceptors
5. Microbial growth and its control
Binary Fission, Budding, and Biofilms; Quantitative Aspects of Microbial Growth; The Microbial Growth Cycle; Kinetics of growth (Monod equation); Bacterial growth in continuous culture; Culturing Microbes and Measuring Their Growth; Environmental Effects on Growth; Controlling Microbial Growth
6. Metabolic Diversity of Microorganisms
Photosynthesis; Anoxygenic Photosynthesis; Oxygenic Photosynthesis; Autotrophic Pathways; Nitrogen Fixation; Respiratory Processes Defined by Electron Donor; Respiratory Processes Defined by Electron Acceptor
7. Microbial Ecosystems & Nutrient Cycles
Carbon, Nitrogen, and Sulfur Cycles; Other Nutrient Cycles; Humans and Nutrient Cycling
8. Microbiology of the Built Environment

Public Health and Water Quality; Wastewater and Drinking Water Treatment; Indoor Microbiology and Microbially Influenced Corrosion

Teaching and Learning Methods

This module is taught by a combination of lectures, tutorials and laboratory practicals etc...

Assessment Details²

Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Continuous Assessment 1	Multiple choice tests & Assessments	LO1 – LO8	30%	
Continuous Assessment 2	Laboratory	LO1 – LO8	20%	
Examination	Examination [3 hours]	LO1 – LO8	50%	

Reassessment Requirements

Examination [2 hours]

Contact Hours and Indicative Student Workload²

Contact hours: 40 (27 lecture, 6 labs, 7 tutorial)
Independent Study (preparation for course and review of materials): 30
Independent Study (preparation for assessment, incl. completion of assessment):30

Recommended Reading List

Brock's Biology of Microorganisms, 15th Edition – Madigan et al. [Pearson].

² [TEP Guidelines on Workload and Assessment](#)

	Environmental Biotechnology: Principles and Applications, Second Edition - Bruce Rittmann, Perry McCarty
Module Pre-requisite	n/a
Module Co-requisite	n/a
Module Website	https://www.tcd.ie/Engineering/undergraduate/
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	
Academic Start Year	
Academic Year of Date	