

**CE 311 Introductory Microbiology and Chemistry for Environmental Engineering**

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**Status:** Environmental Elective

**Lecturers:** Dr C.R. Cheeseman (CRC)  
Dr G.D. Fowler (GDF)  
Dr S.R. Smith (SRS)

**Structure:** 40 contact hours of lectures, seminars and essay.

**Links:** CE204 : CE407 & CE408: complementary

### **Introduction**

This module is split into two separate sections, Chemistry and Microbiology.

### **Aims**

An introductory module for engineers that aims to provide a basic knowledge of chemistry and microbiology to allow a more detailed understanding of environmental processes including water and wastewater treatment, air pollution and waste management.

### **SYLLABUS**

1. Origins of environmental microbiology and principles of biology.
2. Environmental and microbiological aspects of water pollution, wastewater and sludge treatment processes.
3. Form, characterisation, growth, metabolism and biochemistry of bacteria.
4. Classification, structure and biochemistry of algae, protozoa and viruses, and their significance in environmental engineering.
5. Biological transformation processes of major nutrients including: N, P and S
6. Aerobic and anaerobic metabolisms.
7. Enteric diseases and their control.
8. Classification of elements, structure of matter and periodic table.
9. Basic chemical reactivity, reversible reactions and equilibria. Kinetics and quantification of chemical change, biological and chemical oxygen demand.
10. Equilibrium reactions as applied to water quality, groundwater treatment and chemical solubility.
11. Introduction to basic organic chemistry including the structure and functional groups of molecules of importance in environmental engineering.
12. Wastewater treatment processes and the composition of wastewater, emphasising the importance of biological macro-molecules, their structure, properties and degradation, including detailed discussion of:
  - Carbohydrates
  - Proteins
  - Fats, oils and lipids
  - Enzymes
13. Analytical chemistry: Basic overview of analytical techniques; units and quantities, instrumentation, data quality, practical examples of analysis, hands on sample analysis and data interpretation.

### **Coursework**

(SRS) Microbiology essay - (Week 16)

(CRC) Chemistry questions - (Week 20)

### **Assessment**

Assessment is through coursework and a 3-hour written examination. *Rubric:* Answer 5 out of 8 questions, at least 2 from Section A and 2 from Section B.

### **Recommended Textbooks/Reading**

Lecture handouts.

J.N. LESTER & J.W. BIRKETT, Microbiology and Chemistry for Environmental Scientists and Engineers. *E & FN SPON*

CIWEM, Handbooks of UK Wastewater Practice

C.N. SAWYER, P.L. McCARTY and G.F.PARKIN, Chemistry for Environmental Engineers.

J.R.AMEND, B.P.MUNDY & M.T.ARNOLD, Chemistry - General, Organic and Biological, *Saunders College Publishing*.

S.L.SEAGER & M.R.SLABAUGH, Chemistry for Today, General, Organic and Biochemistry

DANIEL C. HARRIS, Exploring Chemical Analysis

and other general chemistry and microbiology text books.

### **Learning Outcomes**

At the end of the module a student should be able to

- Understand the underlying and fundamental chemical and biological principles of environmental engineering systems.
- Apply this knowledge in developing solutions to environmental problems, particularly in relation to waste and wastewater treatment engineering.