# MODULE DESCRIPTOR 2021/22
# CL430
## Principles of Environmental Microbiology

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| **Registrar:** Dr Charles W. Knapp | **Taught To (Programme):** Civil & Environmental Engineering | |
| **Other Lecturers Involved:** | **Credit Weighting:** 10 | **Semester:** On campus: 2 |
| **Assumed Pre-requisites:** Background in chemistry will be helpful, but not required | **Optional:** MEng/BEng Civil & Environmental Engineering | **Academic Level:** 4 |

## Class Format and Delivery (hours):

| Lecture | Tutorial | Laboratory | Coursework | Project | Private Study | **Total** |
|---|---|---|---|---|---|---|
| 20 | 0 | 0 | 30 | 0 | 50 | 100 |

## Class Aim(s)

This class aims to introduce microbiology in a manner that is of practical importance in environmental engineering + public health.

Emphasis is placed on the microbial ecology and interactions in water, soil, and biological treatment process. Microbial physiology and biochemistry will be discussed in detail as it pertains to environmental systems. Both biodegradation and public health aspects of microbiology are included. The class combines theoretical and fundamental concepts in biology to provide a basic background in microbiology and biotechnology.

## Learning Outcomes

On completion of the class the student is expected to be able to

LO1: conversant of microbiology such that they can communicate about biological systems;
LO2: relate principles of microbiology to understanding microbial performance and activity;
LO3: unravel the complexity of their interactions and propose solutions to optimise their biotechnical application.

## Syllabus

The class will teach the following:

1. Historical influences of microbiology and biotechnology – to the projection of future endeavours
2. Cellular biology
3. Genetics & central dogma of life
4. Biosynthesis & metabolism
5. Redox reactions & nutrient cycles
6. Enzymes
7. Population & community interactions
8. Aquatic & soil microbiology
9. Biotechnology
10. Genetic pollution

## Assessments

HW #1: Bug biography (25%)
HW #2: Tortoise & Hare (25%)
Examination: 50%

Practice quizzes provided to help one's preparation.

## Assessment Criteria

For each of the Course Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1: conversant of microbiology such that they can communicate about biological systems
C1: assessment #1 – accurate and technically correct communication of microbiology
C2: examination – (same)

LO2: relate principles of microbiology to understanding microbial performance and activity
C1: assessment #1 – understanding of their nutritional and survival needs
C2: assessment #2 –understanding of how enzymatic and ecological processes impact reactor performance

LO3: unravel the complexity of their interactions and propose solutions to optimise their biotechnical application
C1: assessment #2 – be able to assess situations/project and be able to suggest mitigation strategies
C2: examination – be able to assess and suggest biotechnological strategies

The standards set for each criterion per Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessments.

## Principles of Assessment and Feedback (*https://www.strath.ac.uk/staff/policies/academic/* )

Please state briefly how these are incorporated in this module.

Assessment and feedback practices promote student learning

- Multiple, diverse assessments are utilised to guide student learning process
- General (class-wide) and individual assessments will be provided via MyPlace
- Feedback will be provided within two weeks of submission

Assessment and feedback practices are appropriate, fair and transparent

- Professional-quality report writing and conduct are expected in assignments
- When possible, criteria / rubrics will be provided in advance of assignments
- Feedback will be accessible via Myplace and, in most cases, will be based on pre-determined rubrics.
- Assessment and feedback practices are clearly communicated to students and staff
- Course syllabus will be provided to all students on first day of class – highlighting assignment deadlines, assessment weighting and lecture order
- Rubrics will be provided for assignments
- Clarifications and further feedback could be arranged via individual meeting (if requested)

Assessment and feedback practices are continuously reviewed

- Students will have opportunities to evaluate the course (mid- and final-semester)
- Responses to evaluations (esp. mid-term) will be provided by the class registrar
- Assessments, feedback and course evaluations are reviewed by external examiner, examination boards, and accreditation reviews.

## Recommended Reading

Highly recommended reading (accessible online via library):

- Madigan et al. (2017) Brock Biology of Microorganisms (Global Edition, 15th), Pearson Education:

Optional, selected chapters from (accessible online via library):

- Bertrand JC, Caumette P, et al. (2015) Environmental Microbiology: Fundamentals and Applications, Springer Science + Business Media, Dordrecht
- Madsen EL (2015) Environmental Microbiology: from Genomes to Biogeochemistry, 2nd ed. Hoboken, NY
- Okafor N (2011) Environmental Microbiology of Aquatic and Waste Systems. Springer Science + Business Media, Dordrecht:
- Hurst CJ (2019) Understanding Terrestrial Communities. Springer Science + Business Media, Dordrecht

**PLEASE NOTE:**
**Students need to gain a summative mark of 40% (CL430) to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam.**

## Resit Arrangements

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| Examinations for on-campus students will be during the August diet as scheduled by the university. Resits will comprise entirely of examination, and scored as such (100%) |

## Approved

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| Programme Director Signature: Charles W. Knapp |
| Date of Last Modifications: 09 July 2021 |

## Assessment and Feedback Schedule

| Class Code | CL430 | Class Title | Principles of Environmental Microbiology |
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## Brief Description of Assessment

HW #1: Bug biography (25%)
HW #2: Tortoise & Hare (25%)
Examination: 50%

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

## Semester 2 or Semester 3

| Assessment type (& title) | LOs | Weight (%) | Individual / Group | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 | WK10 | WK11 | Exam Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HW #1 | 1-2 | 25% | Individual | (H) | | (S) | | (F) | | | | | | | |
| HW #2 | 2-3 | 25% | Individual | | | (H) | | | | | (S) | | (F) | | |
| Exam | 1-3 | 50% | Individual | | | | | | | | | | | | (E-2h) |

## Mapping Module Learning Outcomes to AHEP

| Module Learning Outcome | Engineering Council AHEP competencies: Knowledge, Understanding and Ability |
|---|---|
| LO1: conversant of microbiology such that they can communicate about biological systems | • **Math & Science**: A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies<br>• **Design**: Communicate their work to technical and non-technical audiences |
| LO2: relate principles of microbiology to understanding microbial performance and activity; | • **Math & Science:** A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations<br>• **Engineering analysis**: Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems. |
| LO3: unravel the complexity of their interactions and propose solutions to optimise their biotechnical application. | • **Math & Science**: Awareness of developing technologies related to own specialisation<br>• **Design**: Apply advanced problem-solving skills, technical knowledge and understanding to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal<br>• **Engineering analysis:** Ability to use fundamental knowledge to investigate new and emerging technologies |

## JBM Programme Threads

| Thread | Primary | Secondary | Contributory |
|---|---|---|---|
| Design | | LO3 (HW #2, exam) | |
| Health, Safety & Risk Assessment | | LO1 (HW #1, exam) | |
| Sustainability | LO 2-3 (HW #1, exam) | | |
| Maths for Engineers | | | LO 2-3 (HW #2) |
| Industrial Engagement | | | |
| Digital Technologies | | | |