MODULE DESCRIPTOR 2021/2
CL328 Environmental Engineering

Registrar: Dr Christine Switzer	**Taught To (Programme):** MEng/BEng Civil Engineering; MEng/BEng Civil & Environmental Engineering	
Other Lecturers Involved:	**Credit Weighting:** 10	**Semester:** 1
Assumed Pre-requisites: MM115 and MM215 (or equivalent)	**Compulsory**	**Academic Level:** 3

Class Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
20	0	6	20	20	34	100

Class Aim(s)

In its Charter for Sustainable Development, the Institution of Civil Engineers mandates that "sustainable development is central to civil engineering," and that the profession must "protect and enhance the environment and to use resources in a way that does not disadvantage future generations." Environmental engineers work at the interfaces between the built and natural environments, linking fundamental science and engineering to address complex problems. This class aims to provide an overview of how to apply engineering principles to mitigate, adapt to, or prevent human effects on the environment.

Learning Outcomes

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

LO1: recognise the interplay between engineering and the environment (especially their consequential impacts and risks on each other).
LO2: use fundamental scientific and engineering principles to develop representations of environmental systems
LO3: understand the interfaces between human and environmental health
LO4: demonstrate a working knowledge of environmental impact assessment, mitigation strategies, and enhancement

Syllabus

The class will teach the following:

1: Introduction to Environmental Science and Engineering (Switzer)
2-3: Material and Energy Balances in the Environment (Switzer)
4: Environmental Chemistry (Switzer)
5: Environmental Biology (Switzer)
6: Risk Perception, Exposure Assessment, and Risk Management (Allen)
7: Environmental Impact Assessment (Allen)
8: Ecology and Ecosystem Services (Allen)
9: Hydrology and Water Resources (Allen)
10: Environmental Engineering and the Circular Economy (Allen)

Assessment Criteria

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

LO1: recognise the interplay between engineering and the environment (especially their consequential impacts and risks on each other)
C1 identify the interactions between infrastructure development and environmental impacts
C2 understand key scientific principles affecting environmental systems

LO2: use fundamental scientific and engineering principles to develop representations of environmental systems
C1 identify key mass and energy balances governing environmental systems
C2 identify key assumptions that affect these systems and potential simplifications
C3 evaluate representations of these systems using mathematical techniques
C4 determine the effects of uncertainty on these systems and mathematical solutions

LO3: develop solutions to complex environmental problems taking into account the principles of sustainable development
C1 identify engineering solutions to complex environmental problems
C2 determine key specifications that must be met in developed solutions
C3 apply engineering judgment to evaluate proposed solutions

LO4: demonstrate a working knowledge of environmental impact assessment, mitigation strategies, and enhancement
C1 identify potential environmental impacts (positive and negative) associated with development
C2 apply the precautionary principle in evaluating impacts
C3 develop mitigation and enhancement strategies for impacts that can support development when appropriate
C4 identify situations, perhaps because mitigation is insufficient, where development is inappropriate

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.
- General (class-wide) and individual assessments will be provided via MyPlace.
- Small, formative assessments, some of which are for credit, will provide rapid feedback to students.
- Feedback on substantial written assessments will be provided within three weeks of submission, as per Departmental policy.

Assessment and feedback practices are appropriate, fair and transparent

- Professional-quality report writing and conduct are expected in assignments.
- Assessment criteria and 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 before the first day of class with assignment deadlines indicated.
- Clarifications and further feedback are possible via individual meeting upon request.

Assessment weighting and lecture order

- Rubrics will be provided for assignments.
- Class structure includes both lecture and tutorial.

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.
- Class performance is also reviewed via ENTICE surveys at the end of each academic year.

Recommended Reading

Recommended: Davis & Masten (2013) *Principles of Environmental Engineering and Science*. McGraw Hill, 3rd edition (ISBN 9781259060472)

Strongly Recommended: MacKay DJC (2009) *Sustainable Energy without the Hot Air*.

PLEASE NOTE:

Students need to gain a summative mark of 40% (CL328) 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

Coursework or examination before or during the August examination diet.

Approved

Programme Director Signature: *Christine Switzer*
Date of Last Modifications: 31 August 2021

Assessment and Feedback Schedule

Class Code	CL328	Class Title	Environmental Engineering

Brief Description of Assessment

Quizzes 3% x 5= 15%
Lab: 15%
Design Project: 20%
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
Quiz 1	1	3%	Individual		H	S	F								
Quiz 2	2	3%	Individual				H	S	F						
Quiz 3	3	3%	Individual						H	S	F				
Quiz 4	4	3%	Individual								H	S	F		
Quiz 5	1-4	3%	Individual									H	S	F	
Lab Report	1-2	15%	Individual or Group		H				S		F				
Project	2-3	20%	Individual or Group						H				S	F	
Exam	1-4	50%	Individual												(Online exam – 27 hrs)

Mapping Module Learning Outcomes to AHEP

Module Learning Outcome	Engineering Council AHEP competencies: Knowledge, Understanding and Ability
LO1: recognise the interplay between engineering and the environment (especially their consequential impacts and risks on each other)	• **Engineering analysis:** Ability to use fundamental knowledge to investigate existing, new, and emerging technologies • **Science and mathematics:** Knowledge and understanding of fundamental scientific principles that influence environmental problems and solutions. • **Economic, legal, social, ethical and environmental context (ELSEEC):** Knowledge and understanding of the commercial, economic and social context of engineering processes
LO2: use fundamental scientific and engineering principles to develop representations of environmental systems	• **Science and mathematics:** Ability to apply fundamental scientific and mathematical principles to represent environmental problems • **Engineering analysis:** Ability to define assumptions and boundary conditions to environmental engineering problems. Knowedge and understanding of the limitations of those assumptions. • **Design:** Knowledge and understanding of conventional systems to address well known environmental engineering problems. • **Engineering practice:** Knowledge and understanding of the challenges to managing and updating ageing environmental engineering infrastructure.
LO3: develop solutions to complex environmental problems taking into account the principles of sustainable development	• **Design:** Ability to investigate and define the problem. Ability to identify key constraints including environmental and sustainability limitations; ethical considerations; health and safety for site workers and communities; codes of practice; and standards. Knowledge and understanding of risk assessment and management. • **ELSEEC:** Knowledge and understanding of the commercial, economic and social context of engineering processes • **ELSEEC**: Knowledge of professional codes of conduct and how ethical dilemmas can arise. Understanding of the need for a high level of professional and ethical conduct in engineering.
LO4: demonstrate a working knowledge of environmental impact assessment, mitigation strategies, and enhancement	• **Design:** Knowledge and understanding of environmental impact assessment approaches, mitigation techniques, and opportunities for enhancement • **ELSEEC:** Knowledge and understanding of the commercial, economic and social context of engineering processes .

JBM Programme Threads

Thread	Primary	Secondary	Contributory
Design	LO3-4		LO2

Health, Safety & Risk Assessment		LO1	LO2
Sustainability	LO1-4		
Maths for Engineers	LO1-2		
Industrial Engagement			
Digital Technologies			