MODULE DESCRIPTOR 2019/20

CL136 The Environment and Infrastructure

Registrar: Dr Iain Beverland	**Taught To (Programme):** Civil Engineering; Civil and Environmental Engineering	
Other Lecturers Involved: Dr Jen Roberts	**Credit Weighting:** 10	**Semester:** 2
Assumed Pre-requisites: None	**Elective class**	**Academic Level:** 1

Class Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
16	4	0	0	40	40	100

Class Aim(s)

The aim of this class is to provide a broad understanding and awareness of environmental, economic & social contexts in which civil engineers design & build infrastructure in response to societal needs. The class develops student skills in applying risk-based analytical approaches to examine historical and contemporary case studies concerning the environment & people; and their critical relationship with civil engineering professional practice.

Learning Outcomes

On completion of the class students are expected to be able to:
LO1 Describe the environmental impacts (both positive and negative) of civil engineering infrastructure.
LO2 Understand and describe the principles of sustainable development from a risk-based perspective.
LO3 Understand and develop broad-based sustainable development objectives for civil engineering projects.
LO4 Describe key future challenges for the civil engineering profession, including critical challenges associated with management of environmental pollution, and global impacts of climate change on people & infrastructure.

Syllabus

Part A: Effects of people on environment (Energy, Climate change, Sustainability)

Topic 1. Global environmental challenges

Impacts on, and of, global climate change – sea levels, temperatures, rainfall patterns and intensity. Improving resilience of infrastructure. Future challenges for civil engineers including: energy supply; water resources; built environment; transport; flooding; landslides; forest fires. Disaster management. Ecology & biodiversity.

Topic 2. Principles of sustainable development.

Why develop sustainably? Sustainable development definition: the balancing of economic, environmental and social issues to obtain a sustainable solution. Sustainable use of resources. Circular economy. Sustainable design (including embedded carbon). Waste management & recycling (construction waste, design for waste minimisation).

Sustainability & risk management case studies 1: Role of geo-energy in climate change mitigation and adaptation; Cement production (including CCS); Caledonia Clean Energy (Grangemouth); ACOM (Aberdeen); Mining.

Part B: Effects of environment on people (Water/food; Built environment; Work; Pollution)

Topic 3. Environmental & public health impacts of civil engineering infrastructure.

Built environment and transport infrastructure impacts on people. Environmental pollution, waste management & public health.

Topic 4. Risk assessment & risk management

Underlying principles of assessment and management of environmental & public health risks. Association vs. causation. Environment vs. genetics vs. lifestyle.

Topic 5. Developing sustainable development objectives for civil engineering projects.

How are sustainable development objectives developed for engineering projects? Dealing with complexity, taking value-based decisions and designing the best solution(s). Sustainable building design (including CEEQUAL, BREEAM). Overview of environmental regulation & constraints. Introduction to impact assessments – environmental, social, and health.

Sustainability & risk management case studies 2: Queensferry crossing; A9 development; AVENUES project Glasgow

Assessment Criteria

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

LO1 Describe the environmental impacts (both positive and negative) of civil engineering infrastructure.
C1 Understanding of the concepts and main components of risk-based approaches to assessing & managing impacts on environmental conditions and people.
C2 Ability to demonstrate how civil & environmental engineering can provide key solutions to environmental problems

LO2 Understand and describe the principles of sustainable development from a risk-based perspective.
C1 Awareness of how economic, environmental and social issues can be balanced to obtain sustainable solutions to key contemporary environmental challenges.
C2 Ability to analyse and interpret quantitative example information to illustrate general concepts
C3 Ability to summarise and present complex inter-disciplinary information, including scientific writing & presentation skills

LO3 Understand and develop broad-based sustainable development objectives for civil engineering projects.
C1 Understanding of how sustainable development objectives are incorporated within engineering projects.
C2 Understanding of environmental, social, and health impact assessments for civil engineering projects

LO4 Describe key future challenges for the civil engineering profession, including critical challenges associated with the management of environmental pollution, and the global impacts of climate change on people and infrastructure.
C1 Understanding of how resilience of infrastructure can be improved to adapt to the impacts of global climate change.
C2 Appreciation of future challenges for civil engineers including: energy supply, water resources, built environment, transport.
C3 Ability to interpret and summarise key issues from relevant case studies.

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.

1. A range of assessment activities are used including poster presentations and an examination.
2. All assessments are clearly related to the learning outcomes and assessment feedback is provided against clearly stated criteria.
3. Assessments and methods are clearly explained to students at the start of the course.
4. The effectiveness of the assessment and feedback methods are reviewed at the end of the course and any recommended changes are implemented in the next academic year

Recommended Reading

Agius R M (2019) Health, Environment and Work. Internet teaching resource in Environmental and Occupational Health: http://www.agius.com/hew/

Bramald TM , Heidrich O, Hall JA (2015) Teaching sustainability to first year civil engineering students. Proceedings of the Institution of Civil Engineers. Engineering Sustainability 168 April 2015 Issue ES2 Pages 93–101 http://dx.doi.org/10.1680/ensu.14.00007

Broadbent O , Think Up (2012) Embedding Sustainability in the Undergraduate Civil Engineering Curriculum https://thinkup.org/reports/embedding-sustainability-in-the-undergraduate-civil-engineering-curriculum/

Clay's handbook of environmental health. 19th ed.. London ; New York : Spon Press 2004

Davis M. & S. Masten (2013) Principles of Environmental Engineering and Science. McGraw Hill, 3rd Edition (ISBN 9781259060472).

Hadjri K, Onyango J (2012) The sustainability of new urban developments in Dubai. Proceedings of the Institution of Civil Engineers. Urban Design and Planning 166 April 2013 Issue DP2. Pages 119–125 http://dx.doi.org/10.1680/udap.10.00023

Houghton J (2015) Global Warming: The Complete Briefing. Cambridge University Press, 5th Ed:

Institution of Structural Engineers (2011) A short guide to embodied carbon in building structures. ISBN 9781906335199 https://www.ihssso.com

Institution of Structural Engineers (2014) Building for a sustainable future: an engineer's guide. ISBN 9781906335212 https://www.ihssso.com

Joint Board of Moderators [JBM] (2018) Guidelines for developing degree programmes. Annex C: Sustainability in degree programmes. https://www.jbm.org.uk/Accreditation-guidance

Kelbaugh D (2011) The environmental paradox of cities: getting around Dubai. Proceedings of the Institution of Civil Engineers. Urban Design and Planning 164 September 2011 Issue DP3 Pages 143–146 http://dx.doi.org/10.1680/udap.2011.164.3.143

Shackman L, Climie D (2016) Planning and procurement of the Queensferry Crossing in Scotland. Proceedings of the Institution of Civil Engineers. Civil Engineering 169 November 2016 Issue CE4 Pages 161–168 http://dx.doi.org/10.1680/jcien.16.00006

MacKay DJC (2009) Sustainable Energy without the Hot Air https://www.withouthotair.com/

Thompson P (2010) Teaching sustainability in civil engineering using Ceequal Proceedings of the Institution of Civil Engineers. Engineering Sustainability 163 December 2010 Issue ES4. Pages 209–217. http://dx.doi.org/10.1680/ensu.2010.163.4.209

Weiner R F, Matthews R A (2003) Environmental engineering [internet resource] 4th ed. Amsterdam ; Boston : Elsevier; Science Direct (Online service) https://www.sciencedirect.com/book/9780750672948/environmental-engineering

PLEASE NOTE:

Students need to gain a summative mark of 40% 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 coursework.

Resit Arrangements

Coursework (100%)

Approved

Programme Director Signature: Iain Beverland
Date of Last Modifications: 13 August 2019

Assessment and Feedback Schedule

Class Code	CL136	Class Title	The Environment and Infrastructure

Brief Description of Assessment

Coursework

Two abstracts and two poster presentations for selected case studies (30% weighting).

Examinations

End of Semester Exam, 2 Hours Duration (70% weighting).

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

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Abstract & Poster 1		15			H		S		F						
Abstract & Poster 2		15							H		S		F		
Exam		70													E(2)

.Mapping Module Learning Outcomes to AHEP

Module Learning Outcome	**Engineering Council AHEP competencies: Knowledge, Understanding and Ability**
LO1 Describe the environmental impacts (both positive and negative) of civil engineering infrastructure.	• Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards • Work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies • 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 • Plan and manage the design process, including cost drivers, and evaluate outcomes • Communicate their work to technical and non-technical audiences • Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations
LO2 Understand and describe the principles of sustainable development from a risk-based perspective.	• Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise • Knowledge and understanding of the commercial, economic and social context of engineering processes • Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering objectives, their limitations and how they may be applied appropriately • Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk • Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction.
LO3 Understand and develop broad-based sustainable development objectives for civil engineering projects.	• Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate • Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally • Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems. • Apply their skills in problem solving, communication, working with others, information retrieval and the effective use of general IT facilities
LO4 Describe key future challenges for the civil engineering profession, including critical challenges associated with management of environmental pollution, and global impacts of climate change on people & infrastructure.	• Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems • Ability to use fundamental knowledge to investigate new and emerging technologies

JBM Programme Threads

Thread	Primary	Secondary	Contributory
Design			LO1-4
Health, Safety & Risk Assessment		LO1-4	
Sustainability	LO1-4		
Maths for Engineers			LO1-4
Industrial Engagement	LO1-4		
Digital Technologies			LO1-4