MODULE DESCRIPTOR 2020/21

CL978

Water & Wastewater Treatment Design

Registrar: Dr. Charles W. Knapp	**Taught To (Programme):** All MSc and MRes, Dept. Civil & Environmental Engineering	
Other Lecturers Involved: Prof. Vern Phoenix	**Credit Weighting:** 10	**Semester:** On campus: 1 Online learning: 1, 3
Assumed Pre-requisites: Mathematics at pre-calculus level, introductory chemistry	**Elective**	**Academic Level:** 5

Class Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Coursework	Project	Private Study	**Total**
20	0	0	40	0	40	100

Class Aim(s)

This course aims to develop an understanding of water and wastewater treatment processes, as well as the ability to undertake design calculations sufficient to produce a concept and detailed design of a treatment system.

Learning Outcomes

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

LO1 recognise needs of the client, conceptualise appropriate treatment systems
LO2 understand water treatment processes, including underlying chemical, physical and biological processes
LO3 understand legislation relevant to water and wastewater treatment, and processes required to achieve objectives
LO4 ability to manage imperfect information and uncertainty in design and calculations

Syllabus

The class will teach the following:

- Wastewater characteristics, its standards and legislation
- Principles of mass balance
- Uncertainty analyses
- Principles of primary, secondary, and tertiary wastewater treatment
- Sludge treatment & disposal, including contemporary concerns towards “one health”
- Water treatment processes, its standards and legislation
- Principles of environmental chemistry and its impact on water quality: e.g., filtration, adsorption, pH, coagulation, and disinfection

Assessments

HW #1: conceptual design (20%)
HW #2: mass balance model (30%)
Exam (50%)

Practice quizzes are provided for additional preparation

Assessment Criteria

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

LO1 recognise needs of the client, conceptualise appropriate treatment systems
C1 Assessment #1–ability to understand socio-economic, environmental and societal value to select a treatment process

LO2 understand waste treatment processes, including underlying chemical, physical and biological processes.
C1 Assessment #1 – application of appropriate technology for the needs of the client
C2 Assessment #2 – mass-balance accounting of pollutants of concern; understanding of reactor kinetics/processes
C3 Examination

LO3 understand legislation relevant to water and wastewater treatment
C1 Assessment #1 – ability to relate appropriate technology for the needs of the population
C2 Assessment #2 – recognition of design targets; and how unit processes can incrementally contribute towards goals

LO4 ability to manage imperfect information and uncertainty in design and calculations
C1 Assessment #2 – be able to assess situations/project and be able to suggest mitigation strategies; ability make decisions in the absence of perfect information (make reasonable, educated guesses); capable of determining robust
nature of design given inherent uncertainties.
C2 Examination

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

Metcalf and Eddy. Wastewater Engineering: Treatment and Reuse.
(Good for details and specific treatment-design requirements)

Davis & Masten (2014) Principles of Environmental Engineering and Science. McGraw Hill, 3rd edition.
ISBN #97811259060472
(Good for background and generic design requirements/specifications; mass balance modelling)

Various Environmental Protection Agency technology guidance documents (Ireland and USA) as linked on myPlace.

PLEASE NOTE:
Students need to gain a summative mark of 50% (CL978) to pass the module.

Resit Arrangements

Resit will comprise entirely of exam, and scored as such (100%).
This will occur either during the August resit diet (on-campus PGT students), or by discretion of programme leader following the September boards for the Distance Learning students.

Approved

Programme Director Signature:	Charles W. Knapp
Date of Last Modifications:	12 July 2021

Assessment and Feedback Schedule

Class Code	CL978	Class Title	Water & Wastewater Treatment Design

Brief Description of Assessment

HW #1: conceptual design (20%)
HW #2: mass balance model (30%)
Exam (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 1

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Conceptual design	1-3	20%	Individual	(H)		(S)	(F)								
Mass balance model	2-4	30%	Individual	(H)								(S)		(F)	
Exam	1-4	50%	Individual												(E-2)

Mapping Module Learning Outcomes to AHEP

Module Learning Outcome	Engineering Council AHEP competencies: Knowledge, Understanding and Ability
LO1 recognise needs of the client, conceptualise appropriate treatment systems	• Math & Science: Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects. • Design: Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics • ELSEE: Knowledge and understanding of the commercial, economic and social context of engineering processes
LO2 understand waste treatment processes, including underlying chemical, physical and biological processes.	• 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 • Math & Science: Awareness of developing technologies related to own specialisation
LO3 understand legislation relevant to water and wastewater treatment	• Design: 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
LO4 ability to manage imperfect information and uncertainty in design and calculations	• Math & Science: Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems • Engineering analysis: Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems. • Design: 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

JBM Programme Threads

Thread	Primary	Secondary	Contributory
Design	HW 2: mass balance model		
Health, Safety & Risk Assessment			HW1: conceptual design
Sustainability	HW 1: conceptual design Exam		
Maths for Engineers		HW 2: mass balance model	
Industrial Engagement			
Digital Technologies			