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| Module Code | CE7E04 |
| Module Name | E4: Waste Management and Energy Recovery |
| ECTS Weighting¹ | 5 ECTS |
| Semester taught | Semester 1 |
| Module Coordinator/s | Lecturer(s): Assoc. Prof. Liwen Xiao (Liwen.Xiao@tcd.ie) |
| Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline | <p>On successful completion of this module, students should have</p> <p>LO1. An understanding of the nature of solid waste and the conceptual approaches to solving the problems of its management.</p> <p>LO2. An understanding of the theories and technologies of energy recovery from solid waste.</p> <p>LO3. An understanding of the best available technologies for waste treatment.</p> <p>LO4. An understanding of legislations and regulations relevant to waste management.</p> <p>LO5. An understanding of the relationships between waste management, climate change, circular economy and sustainable development.</p> <p>LO6. The capacity to collect and analyse data for waste management.</p> <p>LO7. The capacity to develop sustainable waste treatment strategies for a region or city.</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Enhanced</p> <p>To think independently - Enhanced</p> <p>To develop continuously - Enhanced</p> <p>To communicate effectively - Introduced</p> |
| Module Content | <p>This module will introduce (1) the definition of waste and approaches to the assessment, management and control of solid waste in its various forms, and (2) the theories and technologies of energy recovery from solid waste.</p> <ul style="list-style-type: none"> • Solid waste: definitions and assessment, liquid, solid and gaseous. • Landfill/landspreading hydrology: processes and modelling. |

- Thermal treatment: Incineration, pyrolysis, gasification.
- Contaminated land: investigation and remediation of contaminated soil and groundwater. Sampling and monitoring; legal issues; risk analysis.
- Energy recovery: heat, electricity and combustible gases recovery from organic waste.

Teaching and Learning Methods

Lectures, tutorials, coursework and field visit

Assessment Details²

Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
|----------------------|--------------------------|-----------------------------------|------------|----------|
| Examination | 3 hours written exam | LO1, LO2, LO3, LO4, LO5, LO6, LO7 | 70% | Week 34 |
| Coursework 1 | Tutorial and assignments | LO2, LO6 | 10% | Week 27 |
| Coursework 2 | Report and field visit | LO1, LO2, LO3, LO4, LO5, LO6, LO7 | 20% | Week 30 |
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Reassessment Requirements

Contact Hours and Indicative Student Workload²

Contact hours:

27 hours of lectures, 3 hours of tutorials and site visits (10 hours)

Independent Study (preparation for course and review of materials):

30 hours; Researching journals; reading text books recommended in module booklist; reviewing lecture material and class notes

Independent Study (preparation for assessment, incl. completion of assessment):

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| | 30 hours; literature review, research methods development, data collection and analysis, completion of end of semester essay; |
| Recommended Reading List | Text books include: Fetter, C.W. CONTAMINANT HYDROGEOLOGY, 1999, Prentice Hall La Grega, M.D., Buckingham, P.L., Evans, G.J., HAZARDOUS WASTE MANAGEMENT, 1994, McGraw-Hill Nathanail, C.P. and Bardos, R.P. RECLAMATION OF CONTAMINATED LAND, 2004, Wiley Tchobanoglous, G., Theisen, H., Vigil, S.A. INTEGRATED SOLID WASTE MANAGEMENT, 1993, McGraw-Hill Williams, P. WASTE TREATMENT AND DISPOSAL, 1997, Wiley |
| Module Pre-requisite | Chemistry and environmental engineering background |
| Module Co-requisite | |
| Module Website | |
| Are other Schools/Departments involved in the delivery of this module? If yes, please provide details. | No |
| Module Approval Date | |
| Approved by | |
| Academic Start Year | 1 st September 2022 |
| Academic Year of Date | 2022/2023 |