Module Code: CL904  
Module Title: Waste Management and Landfill Design  

Module Registrar: Dr T. K. Beattie

Other Lecturers Involved:  
Credit Weighting: 10  
Semester: 2

Compulsory/optimal/elective class:  
Compulsory to MSc Environmental Health  
Academic Level: 5

Prerequisites: None

Module Format and Delivery (hours):

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Tutorial</th>
<th>Assignments</th>
<th>Laboratories</th>
<th>Private Study</th>
<th>Total</th>
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<tbody>
<tr>
<td>20</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>60</td>
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General Aims

To allow students to develop a critical understanding of the process involved with management of primarily municipal solid waste, including storage, collection, treatment methods, and ultimately disposal. Students will also gain knowledge of the regulation associated with such wastes, and the roles of the various agencies involved in the processes.

Specific Learning Outcomes

On successful completion of this class the student will have developed a critical understanding of the principles, theories and concepts behind the management of solid waste this will include:

a. familiarity with the categorisation of solid waste as defined by pertinent Scottish/UK/European legislation
b. be aware of the solid waste arisings within Scotland/UK/Europe
c. be familiar with the regulation involved in controlling solid waste treatment/disposal, including government strategy
d. understand the concepts behind the development of regulation, i.e. to protect human health and the environment, and be aware of current development within this field of regulation
e. be familiar with the methods involved in collection, sorting, transfer and recycling of solid waste, and have an understanding for the drivers behind change in the management of such methods
f. understand the processes and techniques involved in the thermal treatment of solid waste, including incineration, gasification, and pyrolysis, and also be aware of developing thermal technologies for treatment
g. understand the scientific principles of biological treatment of solid waste, including anaerobic digestion and composting, and be familiar with the parameters which controls such processes
h. understand the scientific principles involved in the degradation of solid waste within landfill sites and the parameter which control this process.
i. Appreciate how such landfill degradation process has the potential for environmental pollution and understand the importance of landfill design in relation to pollution prevention.

Syllabus

The module will cover

a. Introduction to Solid Waste Management – definition, categorisation (controlled & non-controlled)
and arisings
b. National Waste Strategy for Scotland and UK and other Regulation pertinent to Solid Waste Management
c. Collection, Recycling & Materials Recovery Facilities
d. Energy from Waste - incineration, gasification, pyrolysis, refuse derived fuel, new thermal technologies
e. Anaerobic digestion and composting of solid waste
f. Landfill – design, operation, waste degradation processes, leachate & gas management
g. Hazardous Waste, Clinical Waste, Construction & Demolition Waste

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

<table>
<thead>
<tr>
<th>Examination</th>
<th>Duration</th>
<th>Weighting</th>
<th>%</th>
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<tbody>
<tr>
<td>Examination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coursework</td>
<td>No. of Assignments</td>
<td>2</td>
<td>Weighting</td>
</tr>
<tr>
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<td>No. of Assignments</td>
<td>2</td>
<td>Weighting</td>
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Coursework / Submission deadlines

<table>
<thead>
<tr>
<th>Coursework Title</th>
<th>Submission Date</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>E51 Waste Area Plans assignment</td>
<td>Sem 2: week 5</td>
<td>15</td>
</tr>
<tr>
<td>E52 Biological treatment assignment</td>
<td>Sem 2: week 10</td>
<td>15</td>
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PLEASE NOTE:
Students need to gain a summative mark of 50% 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 an exam.

Recommended Reading
Waste Disposal & Treatment by Paul T. Williams, 2nd Ed, 2005, published by John Wiley & Sons Ltd
– Main Library, short loan D628.445WIL
SEPA Waste Aware Course – 6 parts
NSCA Pollution Control Handbook (most up to date) - Main Library, short loan

Wider References
National Waste Plan: Scotland 2003
SEPA [www.sepa.org.uk/](http://www.sepa.org.uk/)
Environment Agency guidance for landfill gas management (various guidance documents)
Guidance on monitoring landfill leachate, groundwater and surface water, SEPA 2003

Date of Last Modifications: September 2012
<table>
<thead>
<tr>
<th>Level of Achievement Statement for a JBM Accredited Engineering Module</th>
<th>Module Code: CL904</th>
<th>University of Strathclyde, Department of Civil Engineering</th>
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</thead>
<tbody>
<tr>
<td><strong>Level in Degree Programme</strong> (years 1 to 5)</td>
<td><strong>Module Objectives and/or Principal Outcomes in Support of the Level</strong></td>
<td><strong>Evidence of Achievement (e.g. examination script, design report, dissertation, lab. report, etc.)</strong></td>
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<tr>
<td>EC^UK^ Level (Levels 6 or 7 appropriate to years 4 and 5 resp.) : 7</td>
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**GENERAL LEARNING OUTCOMES**

**Knowledge and Understanding**

- … of the underlying principles and methods involved in the management of solid waste, including familiarity with arisings, collection, treatment, disposal and regulation
- … of the coordination of different waste treatment and disposal methods to establish an integrated waste management strategy
- … of the drivers behind change in waste management practice in relation to social, environmental, ethical, economic and commercial consideration.
- … of the scientific principles involved with the waste degradation and the potential for environmental pollution

**Examination**

Waste Area Plans assignment E51
Biological treatment assignment E52

**Intellectual Abilities**

The course covers a general introduction to the concept of integrated solid waste management, before introducing the science and design behind specific methods of waste treatment or disposal. This allows students to critically apply generalised knowledge of waste management process to specific applications.

**Examination**

Waste Area Plans assignment E51
Biological treatment assignment E52
### Practical Skills

**Ability to:**
- Review literature and synthesise information to develop written reports and graphically presentation work as part of a group work
- Use appropriate IT packages

### General Transferable Skills

- Skills in literature review, analysis, synthesis, and report writing.
- Ability to plan, conduct and report on specific research topics
- Communicate effectively (written, verbal & graphic)
- Familiarity with electronic information resources
- Time management and working to deadlines
- Ability to work effectively independently

### SPECIFIC LEARNING OUTCOMES IN ENGINEERING

<p>| <strong>Underpinning Science and Mathematics</strong> | Comprehensive understanding of the scientific principles involved with waste degradation and the development of new or existing technologies which utilise such principles, and how this relates to environmental pollution and impacts on human health | Examination Waste Area Plans assignment E51 Biological treatment assignment E52 |
| <strong>Engineering Analysis</strong> | Appreciation of evolving inter-disciplinary interface between engineering and science in managing risks to the environment and human health from inappropriate waste disposal | Examination Waste Area Plans assignment E51 Biological treatment assignment E52 |
| <strong>Economic, Social and Environmental Context</strong> | This class is focused on appropriate societal treatment and disposal of solid waste to prevent adverse impacts on the environment and human health | Examination Waste Area Plans assignment E51 Biological treatment assignment E52 |
| <strong>Design</strong> | Design consideration of technology for treatment and disposal of waste to prevent environmental pollution and impact on | Examination Waste Area Plans assignment |</p>
<table>
<thead>
<tr>
<th><strong>Engineering Practice</strong></th>
<th>Requirement for knowledge of waste treatment processes and the impacts they have with regard to engineering design of waste treatment facilities</th>
<th><strong>E51</strong> Biological treatment assignment <strong>E52</strong></th>
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<tbody>
<tr>
<td>human health</td>
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