ENGT 3812 Municipal Solid Wastes (3 Semester Credit Hours)

I. Course Description: Environmental scientists, engineers and technologists are faced with the challenge of how to manage increasing amounts of solid waste. Furthermore, waste management officials are constantly faced with the question "Which option is the most appropriate one in a given situation, and how does it compare to other options?" This course will help to answer this and other questions by presenting the issues of waste handling and disposal-from general management concepts to specific techniques, with a specific focus on municipal wastes. Municipal waste is a special category of wastes. It is the waste generated from human activities other than industrial activities. Most municipal wastes are the refuse generated within and around the household commonly referred to as garbage. These ‘wastes’ have been found to be economically valuable if a good management regimen is adopted. Instead of competing for the diminishing number of landfills, they can be used to generate green energy. This course is designed to explore this particular type of waste. They are an important class of waste and deserve particular attention. In this unit, problems associated with municipal wastes are presented, and possible solutions are discussed. Legislation that affects recycling and disposal is covered.

II. Expected Learning Outcome: The goal of this course is to educate the student in the environmental challenges of Municipal Solid Wastes. This course will provide the student with the knowledge, understanding and skills to respond to these challenges posed by this category of wastes. Behavioral changes from participating in this course include ability to:
   • Identify selected state-of-the-art procedures and techniques for managing municipal solid wastes
   • Demonstrate an understanding of resource recovery, incineration, and landfilling
   • Identify the guidelines for selecting the best waste management option
   • Compare competing management options by examining real-life studies
   • Identify Federal laws on landfill covers

III. General Information for Students

Textbook: Robert E. Landreth and Paul A. Rebers; Municipal Solid Wastes: Problems and Solutions (ISBN: 9781566702157). This textbook is recommended

References:
<http://academics.srull.edu/MacoskeyCenter/Publications/Composting_Booklet.pdf>.

**Prerequisites:** ENGT 2811 Environmental Citizenship, or consent of the instructor.

**Other:** Students are advised to see the department’s student hand book and the university catalogue for applicable rules and regulations as the classes for this course will be conducted strictly according to those rules and regulations. Other rules of conduct may be announced by the instructor.

**IV. Instruction Units/Modules:** This course is designed to give an overall view of how to manage increasing amounts of municipal solid wastes confronted by communities of civilized societies. No laboratory exercises are involved. However, a field trip will be made to local landfill and waste management facility. The units of instruction that will be covered in the course are:
- Unit 1. Recycling
- Unit 2. Waste - Disposal of Hazardous Chemicals/Waste
- Unit 3. Composting, incineration, and landfilling
- Unit 4. Construction quality and quality control for landfills

**V. Evaluation of Learning Outcome:** The knowledge and experience gained in this course will be assessed by the quality of the papers produced by the student following the completion of a unit(s) of instruction and/or a field trip. Below is a tentative plan for evaluating learning outcome:
- Reports from the field trips
- Term papers:
  1. Report paper about overseas regulations and how they affect domestic recycling programs
  2. Report paper about Georgia's scrap tire management program including an assessment of economic and environmental viability
  4. Report paper: Necessary Documentations to ensure construction quality assurance and control of liners and cover systems of a state or county of student’s choice.
## Course Specifications

### Table 1. Course Specifications Matrix

<table>
<thead>
<tr>
<th>#</th>
<th>Instruction Unit</th>
<th>Level of Training/priority</th>
<th>% Course Time</th>
<th>Allotted Time (Weeks)</th>
<th>Location and/or Facilities</th>
<th>Resources/ references</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>Total</td>
<td></td>
<td>100</td>
<td>15</td>
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</tbody>
</table>
Instruction Unit – One  Recycling

Introduction: The scientific, engineering and economic principles behind recycling must be understood in order to improve our ability to use reprocessed materials. Once these principles are applied, our efforts to process and recycle waste would be significantly more efficient and cost-effective. This unit of instruction is a discussion of the rationale for recycling and the various processes involved in municipal waste recycling, from collection, classification, and separation to production of useful material. The student will explore the various technologies and contemporary trends in waste recycling.

Required Entry Behavior Students are expected to be familiar with terms such as recycling, reprocessing, economic value, and clean energy. Student is also expected to be familiar with the category of wastes generated municipally.

Behavioral Objectives At the completion of this unit, the student will be able to:
• Identify the fundamental differences between recycling and reprocessing
• Identify new technologies and trends in recycling.

Learning Activities and Strategies: This unit consists of classroom discussions, reading assignments and a field trip. Reading assignments will include case studies and articles on current trends and technologies. The following is a tentative plan for covering the instructional materials for achieving unit objectives:
• Recycling vs. Reprocessing: The Fundamental Differences 150 minutes
• Recycling Realities and the Glass Container 75 minutes
• Post-Consumer Plastics Recycling 75 minutes
• The Use of Scrap Tires in Cement Rotary Kilns, 37 minutes
• Ground Rubber and Civil Engineering Markets for Scrap Tires 38 minutes
• Field Trip 75 minutes
• Total time 450 minutes (3.0 weeks)

Unit Evaluation: Report paper: Overseas regulations and how they affect domestic recycling programs

References and Recommended Reading:


Instruction Unit – Two Waste Disposal of Hazardous Chemicals/Waste

Introduction: Some of the wastes generated in our communities from our daily activities can be hazardous to human health. The inexhaustible list of these includes broken bottles, household chemicals, inflammables, abandoned metals and leftover lead-base paints. Not only can these wastes pose immediate danger to human, but they also can leach into the water table and pollute our water systems. It is important to understand the nature and characteristics of these wastes in order to handle and dispose them properly and safely. The purpose of this unit of instruction is to equip the student with the knowledge necessary for analyzing municipal wastes to determine their hazardous status. The student will also explore various systems for handling and storage of municipal hazardous wastes. Practical and legal issues relating to hazardous household wastes are discussed in this module.

Required Entry Behavior Students are expected to be able to identify physically harmful substances, and to speculate on the danger of chemicals and other materials.

Behavioral Objectives At the completion of this unit, the student will be able to:
- Identify household hazardous materials
- Identify various systems for waste handling and storage
- Discuss the practical and legal problems relating to proper disposal of hazardous household chemicals/waste

Learning Activities and Strategies: This unit consists of classroom discussions, and reading assignments. The following is a tentative plan for covering the instructional materials for achieving unit objectives:
- Waste Analyses 150 minutes
- Hazardous Household Chemicals/Waste 150 minutes
- Practical and Legal Problems Relating to Proper Disposal of Hazardous Household Chemicals/Waste 75 minutes
- Waste Handling systems and Storage 150 minutes
- Health and Safety Considerations 75 minutes
Total time 600 minutes (4.0 weeks)

Unit Evaluation: Report paper: Georgia's scrap tire management program including an assessment of economic and environmental viability

References and Recommended Reading:
Lee, G. Fred, and Anne Jones-Lee. "Deficiencies in Subtitle D Landfill Liner Failure And."
**Instruction Unit – Three  Composting, incineration, and landfilling**

**Introduction:** Waste generated municipally in our communities may contain a variety of potential pollutants. Proper management of these wastes requires an understanding of appropriate storage and disposal for wastes that cannot be recycled. In the United States, these wastes are managed by landfills, surface impoundments and waste piles, and incineration. This unit is a discussion of the various methodologies employed today for the handling and disposal of municipal wastes. Composting, incineration, and landfill technologies are presented.

**Required Entry Behavior**  Students are expected to be familiar with the types of waste generated municipally.

**Behavioral Objectives**  At the completion of this unit, the student will be able to:
- Identify various compost systems and their applications
- Identify the state-of-the-art technologies and evaluation techniques determined by the U. S. Environmental Protection Agency to constitute good engineering designs, practices, and procedures for municipal waste management.
- Identify deficiencies in subtitle D landfill liner failure

**Learning Activities and Strategies:**  This unit consists of classroom discussions, reading assignments and a field trip. Reading assignments will include case studies and articles on current trends and technologies. The following is a tentative plan for covering the instructional materials for achieving unit objectives:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
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<tbody>
<tr>
<td>Composting: Programs, Process and Product</td>
<td>75 minutes</td>
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<tr>
<td>Composting Systems</td>
<td>150 minutes</td>
</tr>
<tr>
<td>Composting in Waste Management</td>
<td>75 minutes</td>
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<tr>
<td>The State-of-the-Art in Municipal Solid Waste Combustion in the United States</td>
<td>75 minutes</td>
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<tr>
<td>The Role of a Municipal Solid Waste Incinerator in a Small Community</td>
<td>75 minutes</td>
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<tr>
<td>Cover Systems for Waste Management Facilities</td>
<td>75 minutes</td>
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<tr>
<td>Waste Management Control Strategies for Landfills</td>
<td>75 minutes</td>
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<tr>
<td>Design of Subtitle D and Subtitle C Landfill Containment Systems</td>
<td>150 minutes</td>
</tr>
<tr>
<td>Deficiencies in Subtitle D Landfill Liner Failure</td>
<td>75 minutes</td>
</tr>
<tr>
<td>Field Trip</td>
<td>75 minutes</td>
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<tr>
<td><strong>Total time</strong></td>
<td>900 minutes (6.0 weeks)</td>
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</tbody>
</table>

**Unit Evaluation:**  Report paper: Municipal Solid Waste Incineration with Energy Recovery in the U.S.
References and Recommended Reading:


Instruction Unit Four – Construction quality and quality control for landfills

Introduction: Properly constructed and carefully maintained waste containment facilities protect human health and the environment. In the United States, as in other developed countries, landfills are an important component of municipal waste containment facilities. To function properly, a technical guidance for the complex task of ensuring construction quality control and assurance of liners and cover systems is needed in the building of a landfill. This unit of instruction is devoted to discussion on landfill construction quality.

Required Entry Behavior Students are expected to be familiar with the components of a landfill and the use of landfills.

Behavioral Objectives At the completion of this unit, the student will be able to:

• Prepare the appropriate documentation to ensure construction quality assurance and control of liners and cover systems

Learning Activities and Strategies: This unit consists of classroom discussions, and reading assignments. Reading assignments will include articles on current trends and technologies. The following is a tentative plan for covering the instructional materials for achieving unit objectives:

• Concepts of Manufacturing Quality Assurance (MQA) and Construction Quality Assurance (CQA) 150 minutes
• Construction Quality Assurance/Quality Control for Landfills 150 minutes
  Total time 300 minutes (2.0 weeks)

• Unit Evaluation: Report paper: Necessary Documentations to ensure construction quality assurance and control of liners and cover systems of a state or county of student’s choice.

References and Recommended Reading:
