

FALL 2014

CE-GY 7703 – Solid Waste Management
Division: Graduate – Subject: Civil Engineering

CE-GY 7703 | 3 units | **Class#:** 20089 | **Session:** 1 09/02/2014 - 12/12/2014 | **Section:** I

Class Status: Open | **Grading:** Grad Poly Graded

Course Location Code: BRKLN | **Component:** Lecture

09/02/2014 - 12/12/2014 Tue 6.00 PM - 8.30 PM with Vasiliadis, Haralambos

Instructor: Prof. Haralambos V. Vasiliadis, Ph.D., P.E., DEE, D.WRE, CIH

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Office hours: TBA

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Email Specs: Your subject title AND all attached filenames of your emails should have the following format
"CE-GY7703-FA14-<Lastname><FirstName><MiddleInitial>-<subject>", e.g., "CE-GY7703-FA14-VasiliadisHaralambosV-NotesheetA"

Class hours: Tuesday 18:00 – 20:30

Classroom: RH-425

Catalog Descr.: The course covers engineering aspects of solid waste collection, transport and disposal, including incineration, sanitary landfill, composting, recovery and reutilization. Also covered is the economic evaluation of factors affecting selection of disposal methods.
Prerequisite: Graduate Standing

Textbook: Handbook of Solid Waste Management, G. Tchobanoglous and F. Kreith, 2nd Edition (2002), McGraw-Hill, Inc, ISBN: 0-07-135623-1
Reference(s): Integrated Solid Waste Management – Engineering Principles and Management Issues, G. Tchobanoglous, H. Theisen and S. Vigil, 1993, McGraw Hill, Inc., ISBN: 0-07-063237-5
The Economics of Waste – Resource for the Future, R. C. Porter, 2002, 1-891853-42-2 or 1-891853-43-0

Description: Characterization of solid waste streams. Solid waste generation in municipal, commercial and industrial sectors. Waste minimization by waste reuse and recycling. Analysis of state-of-the-art reuse and recycling technologies. Economics of waste and its impact of reuse/recycling. Implementation of reuse and recycling technologies in major commercial and industrial sectors such as paper, glass, plastics, metals, wood, tire, electronics and construction/demolition wastes. Local, State and national legislative trends and regulatory requirements. Impact of reuse and recycling of wastes on CO₂ emissions, urban sustainability and global warming. Examples of public and private reuse and recycling programs in NY City.

Objectives: The students completing this course will be expected to have acquired a broad analysis of implementing reuse and recycling in the municipal (minor), commercial and industrial (major) sectors in urban areas will be presented in this class. Environmental life cycle assessment of materials will be discussed. The technologies used to process materials for reuse and recycling will be examined with examples from major sectors. The environmental impact of such applications will be covered. Specialized reuse and recycling programs in New York City and other Cities in the US will be examined. Guest speakers will be invited to present programs of particular interest.

No	Date	Topic	Reading	Homework
1		Introduction to integrated solid waste management, sources and quantities	Ch. 1	
2		Federal, State and City/Local legislation, (i.e, RCRA, CERCLA, TSCA, etc.)	Ch. 2, 3, and 4	
3		Solid waste stream characteristics – physical, chemical and microbiological properties	Ch. 5	
4		Collection of solid waste and landfilling – generation, handling, collection, identification/classification, storage, transport, treatment and disposal	Ch. 7 and 14	
5		Hazardous and universal waste management	Ch. 10 and 11A	
6		Other special wastes management (incl. C&D)	Ch. 11 [B, C, D and E]	
7		Life-cycle financial analysis	Ch. 16	
8		MIDTERM EXAM – Chapters 1, 2, 3, 4, 5, 7, 11, and 14 – All assignments up to date are due on this day at 6:50pm		
9		Source quantity and toxicity reduction (inc. reuse)	Ch. 6 [A and B]	
10		Waste-to-energy combustion and emission control	Ch. 13 [A, B and C]	
11		Recycling	Ch. 8	
12		Markets and products for recycled materials	Ch. 9	
13		Composting of municipal solid wastes	Ch. 12	

14		Other waste reuse and recycling options		
15		FINAL EXAM [05/17 – 05/24] – Ch. 6, 8, 9, 12, 13 and 16 – All assignments on or after 3/21 are due on this day at 6:50 pm		

Additional topics to be included/considered:

Separation, Processing and Thermal Conversion Technologies
 Chemical and Biological Conversion Technologies
 Landfills
 Solid Waste Planning and Management
 Modeling/Optimization of Solid Waste Management
 Introduction to Flow through Porous Media - Fate and Transport of Contaminants and Control
 Introduction to Toxicology
 Management Practices – Environmental Audits, Pollution Prevention, and Facility Development and Operations
 Introduction to Treatment and Disposal Methods – Physical and Chemical Processes, Biological and Thermal Methods, Stabilization and Solidification,
 Land Disposal
 Excluded Hazardous Wastes - Radioactive and Infectious Wastes

Grading Policy:

Lecture Presentation:	5%
Product-Specific paper:	15% [10% paper and 5% presentation]
Reuse/Recycling paper:	15% [10% paper and 5% presentation]
Mid-term exam:	25%
Final Exam:	40%
Other Assignments:	to be announced [max 10% as bonus]

Report format: All reports should be single spaced manuscripts with a minimum of 5 references to be listed at the end of the manuscript. Figures and tables can be scanned if appropriately referenced. Use only 8½ "x11" paper. Reports should include the following sections [reference: www.utah.edu, www.utem.edu, www.asce.org, etc.]:

- a) Title Page – Title, Author, Organization, Date
- b) Abstract – A brief (typically 200-word) description of project objectives including investigative methods used, research conclusions and/or applications, and a list of key words that describe the project and identify the major research concept(s).
- c) Acknowledgements [optional] – One or two paragraphs
- d) Table of Contents
- e) List of Figures and Tables
- f) List of Symbols, Variables/Parameters and Abbreviations/Acronyms
- g) Introduction – One or two paragraphs
- h) Literature Review and Background
- i) Theory, Statement of Problem, Governing Principles, Equations, Legislation, etc., and Scope of Work
- j) Experimental/Research Approach/Methodology and Details
- k) Results – Discussion and Comparison
- l) Summary, Conclusions and Recommendations
- m) References
- n) Appendices

Material borrowed or adapted from external sources must be identified and quoted (i.e., document, source, date and page). When referring to a specific figure or table, spell out and capitalize the words "Figure" and "Table". Acronyms must be spelled out the first time used, followed by the acronym in parentheses

Term papers:

1. Product-Specific Waste Management Paper
 Assuming that at your home and work (commercial or industrial facility) you have to manage (including accumulation, storage, transportation, treatment and disposal) a couple of containers with benzene [C₆H₆], a volatile organic compound (VOC).
2. Reuse/Recycling Paper
 Reuse/Recycling of materials constitutes a venue for resource conservation and recovery that has been receiving attention as communities and municipalities consider sustainability of resources as a key element in daily operations. Assuming that you are in charge for the management of one of the following product categories (choose one of the listed categories or propose another category):
 1. Reuse/Recycling of electronics
 2. Reuse/Recycling of construction and demolitions wastes
 3. Reuse/Recycling of hazardous wastes
 4. Reuse/Recycling of paper products

5. Reuse/Recycling of glass bottles
6. Reuse/Recycling of plastic water bottles
7. How do we measure Reuse/Recycling?
8. Materials reuse/recycling and climate change. Is there a connection?
9. Reuse/Recycling of batteries
10. Reuse/Recycling of concrete
11. Reuse/Recycling of organic materials
12. Reuse/Recycling of scrap tires
13. Reuse/Recycling of aluminum cans
14. Reuse/Recycling of wood products
15. Reuse/Recycling of scrap metals
16. Reuse/Recycling programs in higher education institutions
17. Materials reuse/recycling and urban sustainability
18. Reuse/Recycling of industrial materials
19. Reuse/Recycling of structural steel
20. Reuse/Recycling of plastics

For both cases [product-specific and reuse/recycling] write a report including a detailed management protocol that a) would promote and support waste reuse and/or waste recycling, b) would provide incentives for reuse/recycling of such materials/wastes through standard and innovative methods and techniques, and c) would be in compliance with all applicable codes and regulations.

Provide solutions using a) standard management methods and b) innovative management methods. Make sure that in both cases you are in compliance with all applicable federal, state and local codes and regulations. Provide justification for selecting one alternative over another. Finally, provide incentives for searching and adapting an innovative management method. Define clearly your objectives and all applicable constraints. The first part of each report is due on the day of the midterm exam and the second one on the day of the final exam. In the first part, make sure that your report reflects a complete understanding of the product/category properties and the standard methods of managing this product/category [i.e., sections a) Title Page ... to i) Theory, Statement ..., as listed above]. The second part should present all other alternative/proposed options, an evaluations and final conclusions and recommendations [i.e., sections j) Experimental/Research ... to n) Appendices].

Each student will have a different topic and the work must be individual. The manuscript must describe the fundamental principles of reuse/recycling of the materials listed above, why it is significant and beneficial to reuse/recycle them, and data available on the effectiveness of reuse/recycling such materials in the US and abroad

- Assignments:** Use only 8½ "x11" paper. No cover pages. Staple all pages at the top left corner. On the top right corner of the first page of your assignments include your full name, homework assignment, problems solved partially and problems solved completely along with the date of submission. Underline your answers. Use proper graph paper for all graphs, sketches, designs, etc. which meet engineering standards. The overall appearance of your submittals is very important.
- Presentation:** Each group (consisting of 2 students) will be responsible to make one PowerPoint presentation covering the material presented in the previous lecture. The presentation will take place in the beginning of the class (review period) and should last for about 15 minutes including 10 minutes presentation and a 5-minute period for Q&A. Each group will be responsible to prepare slides for everything covered in class. However, due to time limitations, the actual presentation must be limited to a maximum of 10 or 12 slides in order to be presented properly within 10 minutes. By the end of the semester all presentation will be available to all students.