

COURSE CODE: ENE-421
COURSE NAME: Solid Waste Management
CREDIT HOURS: Theory = 3 Practical = 0 Total = 3
CONTACT HOURS: Theory = 48 Practical = 0 Total = 48
PREREQUISITE: None
MODE OF TEACHING: Three hours of lecture per week

COURSE DESCRIPTION:

This course is designed to give the students of Environmental Engineering an insight into the solid waste management starting from its generation to its final disposal, covering the intermediate stages of its collection, transportation, transformation, and treatment.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the PLOs:

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|------------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|
| 1 Engineering Knowledge: | <input type="checkbox"/> | 7 Environment and Sustainability: | <input checked="" type="checkbox"/> |
| 2 Problem Analysis: | <input type="checkbox"/> | 8 Ethics: | <input type="checkbox"/> |
| 3 Design/Development of Solutions: | <input checked="" type="checkbox"/> | 9 Individual and Teamwork: | <input type="checkbox"/> |
| 4 Investigation: | <input type="checkbox"/> | 10 Communication: | <input type="checkbox"/> |
| 5 Modern Tool Usage: | <input type="checkbox"/> | 11 Project Management: | <input type="checkbox"/> |
| 6 The Engineer and Society: | <input checked="" type="checkbox"/> | 12 Lifelong Learning: | <input type="checkbox"/> |

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will demonstrate competency by being able to:

S. No.	CLOs	Domain	Taxonomy Level	PLOs
1	INSPECT the generation, composition, and characteristics of MSW for waste collection and subsequent management	Cognitive	4	6
2	ANALYZE the design and operation of various waste management/treatment options (MRF,	Cognitive	4	7

	Composting and Anaerobic Digestion)			
3	EXAMINE the design and operation of various waste treatment/disposal options (incineration and landfilling)	Cognitive	4	3

Complex Engineering Problem

4	ANLYZE the management options for solid waste generated from the selected source of Islamabad.	Cognitive	4	6
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PRACTICAL APPLICATIONS:

Solid wastes are the essential consequence of the everyday modern life, and the issue needs to be managed in a way that addresses the public health and environmental concerns as well as taking into account the much-needed emphasis on the conservation of natural resources by adopting reuse and recycle of waste materials. The course will cover the introduction to the unit operations involved in the solid waste management starting right from its generation to its final disposal for municipal solid waste. Studying this course, the students will be able to analyse the solid waste issue and propose their own solutions to the related problems.

TOPICS COVERED:

Week	Topic Covered	Reading Assignment/ Homework	CLO #
1	Introduction to the course objectives; Introduction to solid waste management and its history.	Chapter 1 Assignment 1	1
2	Waste sources and types; Solid waste generation, its relationship with population and income, and composition	Chapter 2 & 3 Quiz 1	1
3	Solid waste properties	Chapter 4	1
4	Solid waste properties	Chapter 4, Assignment 2	1
5	Functional elements of solid waste management system; Solid waste management laws	Chapter 5 & 6 Quiz 2	1
6	Waste quantification: AI powered Smart	Chapter 7	1

	Bins; Collection system and required equipment	Quiz 3	
7	Waste collection; transfer systems	Chapter 7	1
8	Waste collection; transport system; Dynamic Scheduling and Routing, AI-controlled waste segregation	Chapter 7	1
9	Mid Semester Exam		
10	Waste recycling; minimization	Chapter 8, CEP Progress	2
11	Waste recycling; processes	Chapter 8	2
12	Aerobic composting of MSW	Chapter 9, Quiz 4	2
13	Anaerobic digestion of MSW	Chapter 10, Assignment 3	2
14	Anaerobic digestion of MSW	Chapter 10, Quiz 5	2
15	Thermal treatment, types, issues China case study: Smart incinerator	Chapter 11, Quiz 6	3
16	Landfilling, methods/types, parts, design considerations	Chapter 12, CEP Final	3
17	Landfill gas management, Landfill leachate management	Chapter 12	3
18	End Semester Exam		

LIST OF PRACTICALS:

Not Applicable

Sr. No.	Practical	CLO #
1		
2		

TEXT AND MATERIAL:

Textbook (s)

1. Tchobanoglous, G., Theisen, H. and Vigil, S. (1993). Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw Hill Pub. Co., ISBN 0-07-112865-4.

References Material:

1. Polprasert, C. and Kootatep, T. (2017). Organic Waste Recycling: Technology, Management and Sustainability, 4th Edition, IWA Publishing, ISBN: 9781780408200.
2. Young, G.C. (2010). Municipal solid waste to energy conversion processes: Economic, technical, and renewable comparisons, John Willey and Sons Inc., ISBN:

978-0-470-53967-5.

3. Tchobanoglous, George and Kreith, Frank (2002). Handbook of Solid Waste Management, Second Edition, McGraw Hill Pub. Co., ISBN 9780071356237.

ASSESSMENT SYSTEM:

Theoretical/Instruction	100%
Assignments (+CEP)	10%
Quizzes	15%
Mid Semester Exam	25%
End Semester Exam	50%

Practical Work	0%
Lab Attendance	0%
Lab Report	0%
Lab Quiz	0%
Lab Rubrics	0%