GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Environmental Engineering

Subject Code : DI04013031

Subject Name : Solid Waste Management

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	PCC

Prerequisite:	Environment and sustainability
Rationale:	This course provides students with an understanding of the sources, characteristics, collection, handling, processing, and disposal of municipal and hazardous solid waste. With the growing urban population and rising waste generation, solid waste management has become a major environmental challenge. Students will learn to apply scientific principles and engineering practices for sustainable waste management. The course emphasizes waste minimization, material recovery, safe handling of hazardous waste, and environmentally sound disposal techniques, preparing students for careers in environmental engineering, municipal services, and industrial waste management.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Identify the sources, composition, and properties of municipal solid waste.	R,U,A
02	Explain the methods of waste generation measurement and collection systems.	R,U,A
03	Demonstrate onsite handling, separation, and storage practices for solid waste.	R,U,A
04	Compare different processing and disposal methods of municipal solid waste with respect to efficiency and environmental impact.	R,U,A
05	Classify hazardous solid waste and evaluate its safe management and disposal methods.	R,U,A

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1. Source, composition and Properties of Municipal Solid Waste	1.1 Introduction 1.2 Sources of solid waste 1.3 Types of solid waste. 1.4 Composition of solid waste and its determination. 1.5 Types of materials recovered from MSW. 1.6 Sampling and characteristics of MSW 1.7 Physical properties ofMunicipal Solid Waste 1.8 Chemical properties ofMunicipal Solid Waste 1.9 Biological properties ofMunicipal Solid Waste 1.10 Transformation of Municipal Solid Waste.	8	18
2. Solid Waste Generation and Collection	2.1 Quantities of Solid Waste. 2.2 Measurements and methods to measure solid waste quantities. 2.3 Solid waste generation and collection. 2.4 Factors affecting solid waste generation rate. 2.5 Quantities of materials recovered from MSW.	7	15
3. Handling, Separation and Storage of Solid Waste	3.1 Handling and separation of solid waste at site. Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation. 3.2 Waste handling and separation at commercial and industrial facilities. 3.3 Storage of solid waste at the sources.	7	15
4. Processing and Disposal of Municipal	4.1 Processing of solid waste at residence e.g. Storage, conveying, compacting, shredding, pulping, granulating etc. 4.2 Processing of solid waste at commercial and industrial site.	15	34

Solid Waste	4.3 Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of combustion. 4.4 Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation, use of old landfill, 4.5 Bio reactor landfill – working, advantages and disadvantages, Landfill rehabilitation 4.6 Differentiate sanitary land fill and incineration as final disposal system for solid waste 4.7 Biochemical processes: Methane generation by anaerobic digestion, composting and other biochemical processes.		
5. Hazardous Solid Waste	5.1 Definition, identification and classification of hazardous solid waste. Characteristics of Hazardous waste: toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness. 5.2 Bio-medical waste, its sources, generation, storage, transportation and disposal. 5.3 Radioactive waste-Sources, Types, Storage and disposal 5.4 Introduction to bio medical waste and e waste	8	18
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
35	**45**	**20**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Integrated solid waste management	GeorgeTchobanoglous and Hillary theisen,	McGraw Hill; 2nd edition (28 February 1993)

S. No.	Title of Book	Author	Publication with place, year and ISBN
		Samuel Vigil	ISBN-13 : 978-0070632370
2	Solid And Hazardous Waste Management	S.C. Bhatia	Atlantic Publishers and Distributors (P) Ltd, January 2023, ISBN-13 : 978-8126908141
3	Hazardous Waste Management	J. M. Dewan	Discovery Publishing Pvt.Ltd(11 August 2008) ISBN-13 : 978-8171413515
4	Solid Waste Management	Sasikumar K	Prentice Hall India Learning Private Limited (1 January 2009) ISBN-13 : 978-8120338692
5	Solid and Hazardous Waste Management	M. N. Rao	BS Publications /BSP Books ;2nd edition(1January 2020)

(b) Open source software and website:

a) www.gpcb.gov.in
b) https://archive.nptel.ac.in/courses/105/103/105103205/
c) www.cpcb.nic.in
d) www.neeri.res.in
e) https://archive.nptel.ac.in/courses/105/106/105106056/

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Determination of moisture content and bulk density of MSW	I	02
2	Determine the Volatile and non-volatile matter of MSW	I	02
3	Determine the Kjeldahl nitrogen of municipal solid waste.	I	04
4	Determine the Total nitrogen of municipal solid waste.	I	02
5	Measurement of daily waste generation in campus (weighing method)	II	02
6	Survey your locality and based on it suggest methods of solid waste collection.	II	02
7	Survey your locality and based on it suggest suitable methods of handling, separation and storage of solid waste.	III	04
8	Identify& discuss the methods of processing different types of	IV	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	solid waste (search internet for latest methods).		
9	Compare different methods of disposal of MSW. (search internet for latest methods).	IV	02
10	Leachate collection and study of leachate parameters	IV	04
11	Case study/demonstration of e-waste dismantling & disposal	V	02
12	Identify methods of hazardous waste disposal during a site visit.	V	02
			Total:30

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	• **Sampling containers** • **Kjeldahl Flask** • **UV Spectrophotometer** • **Distillation Assembly** • **Muffle furnace** • **Chemical testing glasswares** • **Hot air oven**	1 to 4,10

Suggested Project List:

a) Carryout internet survey and prepare a report suggesting methods to manage construction and demolition waste
b) Carryout internet survey and prepare a report suggesting methods to manage bio-medical waste
c) Carryout internet survey and prepare a report suggesting methods to manage e-waste
d) Prepare a chart depicting Functional Elements of MSWM
e) Collect data of MSW generation of India in TPD and prepare bar graph of state wise MSW generation and identify the states with highest MSW generation
f) Prepare a chart depicting various methods of handling and separation of solid waste
g) Prepare a chart depicting various methods of processing of solid waste
h) Prepare a chart depicting various methods of disposal of solid waste
i) Prepare a case study report on waste to energy plant set up using pyrolysis
j) Prepare a case study report on waste to energy plant set up using gasification
k) Prepare a report on Municipal solid waste management rules.

Suggested Activities for Students:

a) Explore internet for studying latest methods of handling, collecting, segregating, recycling and disposing MSW and prepare reports.
b) Prepare Charts/Models for different Hazardous Solid Waste treatment processes.

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