

M.Tech.I Semester I

Subject Name: Municipal and Hazardous Solid Waste Management

Subject
Code: MTEN14101

Type of course: PE-I

Prerequisite: Types of Solid waste, Need for Solid and Hazardous waste management

Rationale: To develop concepts of Municipal & Hazardous Solid Waste management Practices

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Municipal Solid Waste Management: Introduction to Solid Waste Management: History, Material Flows, Need for ISWM, Legislative & Policy aspects of Solid Waste, Circular Economy & Solid Waste, Current Challenges, MSW Characteristics and Quantities, Composition and Generation; Systems and Design; Transportation and Transfer of Wastes, Transfer Stations Need & Design requirements, Handling & Processing, Material Separation, Other Devices, Material Separation Systems, Material Recovery Facilities, Material Recycling	12	30%
2.	Combustion and Energy Recovery: Heat Value of Refuse, Materials and Thermal Balances, Combustion Hardware Used in MSW, Undesirable Effects of Combustion Biochemical Processes: Methane Generation by Anaerobic Digestion, Composting, Other Biochemical Processes Landfills: Planning, Siting, Permitting, Landfill Processes, Landfill Design, Landfill Operations, Post-Closure Care and Use of Old Landfills, Landfill Mining. Application of GIS in Locating Landfill Site, Leachate management	10	20%
3.	Hazardous Solid Waste Management: Definition, Classification of Hazardous Solid Waste, Characteristics of Hazardous Solid Waste Hazardous Waste Management: Waste Minimization, Waste Exchange, Recycling Treatment Technologies: Physico-Chemical Processes, Thermal Methods, Stabilization, Solidification Land Disposal: Site selection criteria, Landfill	10	20%

PE-I: Program Elective -I

	operation, Liner and Leachate collection system, Cover System, Water Controls, Closure & Post-closure		
4.	Biomedical Waste Management: Sources, Generation, Storage, Transportation, Disposal Waste Treatment: Disinfection, Irradiation, Incineration	4	10%
5.	E-Waste Generation & Management: Sources, Global Perspective of E-waste Generation, Current status in India, E-waste Recovery and Recycling technologies, Disposal	4	10%
6.	Radioactive Waste: Sources, Types of Wastes, Management & Containment	2	10%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	20%	20%	15%	15%	10%

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom's Taxonomy**)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Integrated Solid Waste Management	Tchobanoglous	McGraw- Hill, New York, ISBN-10:9339205243	2014	-
2.	Manual on Municipal Solid waste management by Central Public Health and Environmental Engineering Organization,		Government of India, New Delhi	2000	
3.	Hazardous Waste Management	Michael D. LaGrega, Phillip L. Buckingham, Jefferey C. Evans	McGraw- Hill International Edition		2 nd
4.	Management of Municipal Solid Waste	T. V. Ramachandra	TERI, ISBN-10 : 9788179931875	2009	

5.	Solid Waste Management	D K Dr Gupta	NiraliPrakashan, ISBN-10 : 9389686830	2020	
6.	Hazardous Waste minimization	Harry M Freeman	McGraw Hill publications		
7.	Hazardous Waste Incineration	Brunners, Calvin R.			
8.	Solid And Liquid Waste Management Waste To Wealth	RajaramVasudevan, Siddiqui Faisal Zia, Agrawal Sanjeev, Khan Mohammad Emran	PHI Learning Pvt Ltd	2016	

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Define and explain important concepts in the field of solid waste management. (R, U- Cognitive level)	20
CO-2	Understand the characteristics of different types of solid and hazardous wastes and the factors affecting variation. (R, U, N- Cognitive level)	20
CO-3	Suggest suitable technical solutions for treatment of municipal and industrial waste. (U, A, N, C-Cognitive level)	20
CO-4	Understand the role of legislation and policy drivers play in stakeholder's response to the solid waste. (R, U -Cognitive level)	20
CO-5	Apply the basic scientific principles for solving practical waste management challenges. (R, U, A-Cognitive level)	20

LIST OF PRACTICALS:

1. Collection of Municipal solid waste sample.
2. Experiment on moisture content.
3. Collection of data with detail investigation on system of solid waste management and analysis of the system.
4. Exercise of collection route analysis.
5. Preparation of report of a city solid waste management system including positive points and lacunae in the present system.
6. Study of hazardous waste producing industry with details of points of generation in various forms.

Major Equipment:

1. Hot Air Oven
2. Muffle Furnace

List of Open Source/learning website:

- <https://www.youtube.com/watch?v=k0ktJRoRcOA>

PE-I: Program Elective -I

- Introduction to Solid Waste Management
- https://www.youtube.com/watch?v=cjIacnNRLHE&list=PLwdnzlV3ogoXAap_BHeApkcF7M8ntI3hv
- Municipal Solid Waste Management
- <https://www.youtube.com/watch?v=STcFStHsjWo&list=PL3MO67NH2XxIYo-UFN8csPPnEiYVyR0TO>
- Integrate Solid Waste management
- <https://www.youtube.com/watch?v=mnontR8NKqk>
- Types of Collection System
- https://www.youtube.com/watch?v=prsVIHDDCyM&list=PLL9jm6CAGn2UzZZfZzSycEANAQUkc5E_e&index=23
- Hazardous Waste Treatment & Disposal
- https://www.youtube.com/watch?v=cLQbOXuZ7Kc&list=PLL9jm6CAGn2UzZZfZzSycEANAQUkc5E_e&index=26
- Introduction of Radioactive Waste