

## EN504: Hazardous and Solid Waste Management

Teaching Scheme			Credits	Marks Distribution				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE	CE	ESE	CE	
3	2	0	5	70	30	30	20	150

### Course Contents:

Sr. No.	Topics	Teaching Hrs.
1	<p><b><u>Introducing Municipal solid waste Management:</u></b></p> <p>Classification of solid wastes, Source based classification; Type based classification, Solid waste Management (SWM), SWM system, ESSWM and EST, Factors affecting SWM system, SWM-Indian Scenario.</p>	03
2	<p><b><u>Waste Generation Aspects:</u></b></p> <p>Waste generation and composition, Factors causing variation, Waste characterizes-physical, and Chemical, Health and Environment effects-Public health effect, Environmental effects, Waste generation.</p>	03
3	<p><b><u>Waste collection storage and transport:</u></b></p> <p>Collection components, storage-containers/collection vehicles, Container/storage bins, Collection vehicles, Collection operation, transfer station,</p>	03
4	<p><b><u>Source reduction, Product Recovery and Recycling:</u></b></p> <p>Source reduction: Basics, Purpose, Significance of recycling, Recycling programme elements: Source separation; Drop- off/buy back; curbside programme; Storage and collection of recyclable; Collection vehicle for recycling; Processing equipments for recycling; Material recovery facilities(MRF's); Full stream processing, Commonly recycled materials and processes- Paper and card board; Glass; Metal; Plastic; Batteries and Tires</p>	08
5	<p><b><u>Biological Conversion Products: Compost and Biogas:</u></b></p> <p>Composting: Benefits; Processes; Stages; Technologies; Bio Gasification: Anaerobic Processing; Types of Digester; Biogas plants in India.</p>	03

6 **Incineration and Energy Recovery:** 04

Incineration: An Introduction, Combustion of Waste Material; Incineration Objectives, Incineration Technologies-Mass Burning System; Refused Derived Fuel(RDF) System, Modular Incineration; Fluidised Bed Incineration, Energy Recovery, Air Emission and its Control: Gaseous pollutants; Gas Cleaning Equipment..

7 **Waste disposal:** 04

Disposal option, sanitary landfill: principle, landfill process, Landfill gas emission, Composition and properties, Hazards; Migration; Control, Leachate Formation: Composition and Properties; Leachate Migration; Control; Treatment, Landfill Operation Issues: Design and Construction; Operation; Monitoring.

8 **Hazardous Waste: Management and Treatment:** 12

Hazardous waste: identification and classification-Identification; Classification, Hazardous Waste Management- Generation; Storage and Collection; Transfer and Transport; Processing; Disposal, Hazardous Waste Treatment-Physical and Chemical Treatment; Thermal Treatment; Biological Treatment, Pollution Prevention and Waste Minimization.

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**Total Hrs. 40**

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**Reference Books:**

1. Central Public Health and Environmental Engineering Organization (CPHEEO), “*Manual on Municipal Solid waste management*” Government of India, New Delhi, latest edition.
2. Theisen H. and Vigil Samuel A, Tchobanoglous George, “*Integrated Solid Waste Management*” , McGraw- Hill, New York, 1993.
3. Vesilind P.A., Worrell W and Reinhart, “*Solid waste Engineering*”, Thomson Learning Inc., Singapore, 2002.
4. Flintoff , “*Management of Solid Wastes in Developing Countries*”, WHO.
5. Wentz Charles A. “*Hazardous Waste Management*”, Second Edition, McGraw Hill International Edition, New York, 1995.
6. Rosencranz, Divan and Noble, “*Environmental Law and Policy in India*”.