Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	NESC507	Integrated Solid Waste Management	3	1	0	4

Course Objectives

- Impart knowledge in various sources, properties, and management of various Solid Waste.
- The student is expected to know about the regulatory framework for municipal solid waste management.

Overall Learning Outcomes

Upon successful completion of this course, students will be able to:

- This course will provide the knowledge to understand the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of materials and energy from waste based on Indian and international scenarios.

Unit No.	Topics to be covered	Contact Hr (L+T)	Learning outcomes
I	**Introduction to Solid Wastes**: Evolution of Solid Wastes, Waste Generation in Technological Society, Legislative Trends and Impacts in India and Globally, problems Related to Solid Waste Management, **Solid Wastes:** Sources, types, composition, physical, chemical and biological characteristics of solid waste **Special Waste:** Hazardous solid waste, Agricultural, Domestic (urban) wastes, Biomedical waste, E-waste, Plastic Waste and Construction Waste, and Management of lead acid batteries.	8+2	Students will be introduced to solid waste and its problems with the environment.
II	**Engineering principles**: Generation and collection rates, Method used for estimation of waste quantity calculation, separation, storage and processing at source, collection of solid waste, transfer, and transport, hauled container system and stationary container system, analysis of collection systems, optimization of routes, transfer stations, need and types of the transfer station, location of the transfer station. Economic feasibility for collection system and transfer station	8+3	Understanding of the key function unit involved in solid waste generation to disposal.
III	**Solid waste disposal (Sanitary landfilling):** Classification, types and methods of landfilling; Design and operation of landfills; Generation and control of landfill gas and leachate; Landfill liner; Dump site rehabilitation	8+3	This unit will help the students understand the design and operation of a solid waste landfill
IV	**Separation, Transformation, and Recycling of Waste Materials:** Material Separation and Processing Technologies: Unit operations design for separation and processing of Waste material: Size reduction, Size separation, Density Separation, Magnetic and Electric Field Separation, Densification, Conveying, Design of MRF Thermal Conversion Technologies: Fundamentals of thermal processing, Combustion, Pyrolysis, Gasification systems, Environmental Control Systems, Energy recovery systems, and Particulate separation systems from flue gases. Biological and Chemical Conversion Technologies: Biological principles, Aerobic decomposition process, Anaerobic processes: Low and High solid systems, Design of Anaerobic digesters, Design of other biological treatment processes, Energy production from Biological Conversion products Disposal Techniques for Plastic wastes and E-waste. Life Cycle Assessment of Waste	10+4	The student will develop an understanding of various waste-to-energy techniques.
V	**Integrated Solid Waste Management and Case Studies:** Components of Integrated SWM. Sustainable SWM techniques at source: Segregation and sorting, reduce, reuse, and recycle. Present scenario of SWM in Urban Local Bodies: Current practices and deficiencies; Case studies of some of	5+2	Students will develop a comprehensive idea on integrated solid waste management techniques.

	the successfully operating waste-to-energy plants; Role of informal sectors in SWM		
VI	**Laws and Regulations: Salient Features of Solid Waste Management Rules, 2016:** Duties and responsibilities of waste generators and other stakeholders (Ministries, Pollution control boards, Local authorities, Manufacturers, Industries, etc.); Criteria for setting up solid waste management facilities; Time frame for implementation and monitoring etc.	3	Students will have an idea on the laws and regulations applicable for solid waste management.
		42+14	

Text Books:

1. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (2014). Integrated Solid Waste Management: Engineering Principles and Management Issues. New Delhi: McGraw-Hill Education (India) Private Limited.
2. Khan, I. H., & Ahsan, N. (2012). Textbook of solid waste management. New Delhi: Satish Kumar Jain for CBS Publisher and Distributors.

Reference books:

1. Peavy, H. S., Rowe, D. R., &Tchobanoglous, G. (2010). Environmental Engineering. New York: McGraw-Hill.
2. Tchobanoglous, G., &Kreith, F. (2002). Handbook of Solid Waste Management-Second Edition. New York: McGraw-Hill.
3. CPHEEO (2000). Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organisation, Ministry of Urban Development, Govt. of India, New Delhi.
4. Williams, P. T. (2005). Waste treatment and disposal-Second Edition. London: John Wiley & Sons