

**Name of the Programme:** M.Sc. Biotechnology

**Course Code:** GBT-621

**Title of the Course:** SOLID WASTE MANAGEMENT

**Number of Credits:** 3

**Effective from AY:** 2022-23

<b>Pre-requisites for the Course:</b>	Basic Knowledge of Microbiology and Environmental Science/ Environmental Technology.	
<b>Course Objectives:</b>	<ol style="list-style-type: none"><li>1) To develop required skills in Plan segregation, collection, transportation, recycling and disposal of municipal solid waste</li><li>2) To give an overview of municipal solid waste management, Methods of processing, basic disposal facilities, treatment options, and the environmental issues of solid waste management.</li><li>3) Provide relevant information about municipal solid waste reduction and on hazardous waste management.</li></ol>	
<b>Content:</b>	<p style="text-align: center;"><b><u>MODULE I</u></b></p> <ul style="list-style-type: none"><li>• Introduction, Sources and Composition of Municipal Solid Waste, Sources of solid waste, Types of solid waste, Composition of solid waste and its determination, Types of materials recovered from MSW.</li><li>• Properties of Municipal Solid Waste: Physical, Chemical, and Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.</li><li>• Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.</li></ul>	15
	<p style="text-align: center;"><b><u>MODULE II</u></b></p> <ul style="list-style-type: none"><li>• Handling, Separation and Storage of Solid Waste: -Handling and separation of solid waste at site.</li></ul>	15

	<p>Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation.</p> <p>-Waste handling and separation at Commercial and industrial facilities.</p> <p>-Storage of solid waste at the sources.</p> <ul style="list-style-type: none"> <li>Processing of Solid Waste: <ul style="list-style-type: none"> <li>-Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc. Processing of solid waste at Commercial and industrial site.</li> </ul> </li> </ul>	
	<p style="text-align: center;"><b><u>MODULE III</u></b></p> <ul style="list-style-type: none"> <li>Treatment of the Municipal Solid Waste: <ul style="list-style-type: none"> <li>-Biochemical processes and advanced methods: Methane generation by anaerobic digestion, composting, Mechanical-biological treatment (MBT) and other biochemical Processes.</li> <li>- Treatment of solid waste at wastewater treatment plants: Advanced methods - Anaerobic co-digestion of the sewage sludge with liquid wastes such as septage, Novel composting methods (such as terra-preta of the sludge (biomass).</li> <li>-Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion.</li> <li>-Landfill: Classification, planning, siting, permitting, landfill processes, landfill design, landfill operation, use of old landfill.</li> <li>-Differentiate sanitary land fill and incineration as final disposal system for solid waste.</li> </ul> </li> <li>Hazardous Solid Waste: <ul style="list-style-type: none"> <li>-Definition, sources, identification, classification and characterization of hazardous solid waste.</li> <li>-Hazardous waste toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness.</li> </ul> </li> </ul>	15

	<p>-Bio-medical waste, its sources, generation, storage, transportation and Disposal.</p> <p>-Solid waste management and sustainable development: Case studies</p>	
<b>Pedagogy:</b>	Lectures, tutorials, Case studies, assignments.	
<b>References/ Readings:</b>	<ol style="list-style-type: none"> <li>1. A. K. Chatterjee, Introduction to environmental biotechnology. PHI, India, 2011.</li> <li>2. M. L. Davis, A. David , Environmental Engineering. McGraw Hill Education, 2017.</li> <li>3. T. George, T. Hillary, and V. Samuel, Integrated solid waste management . McGraw Hill Publisher, 2014.</li> <li>4. M.E. Henstock, Disposal and recovery of municipal solid waste Butterworths publication, 1983.</li> <li>5. R. B. King, J. K. Sheldon, and G. M. Long, Practical Environmental Bioremediation: The Field Guide, Lewis Publishers., 1998.</li> <li>6. M. Prabhu, Resource recovery from wastewaters for sustainable development, 2016. shodhganga.inflibnet.ac.inhttp://hdl.handle.net/10603/84904</li> <li>7. T. Satyanarayana, B. Johri, and T. Anil, Microorganisms in Environmental Management, Springer Publishers., 2012.</li> <li>8. A. Scragg, Environmental Biotechnology. Pearson Education Limited. 2007.</li> <li>9. H J Rehm and G. Reed, Biotechnology, a comprehensive treatise, VCH Verlag. 1999.</li> </ol>	
<b>Course Outcomes:</b>	<p>At the end of this course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. explain solid waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies.</li> <li>2. outline sources, types and composition of solid waste with methods of handling, sampling and storage of solid waste.</li> <li>3. select the appropriate method for solid waste collection, transportation, redistribution, disposal and treatment.</li> <li>4. describe methods of disposal of hazardous solid waste.</li> </ol>	