Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B. Tech.)

Subject: Solid Waste Management – BETCV15324
Type of Course: Professional Elective Courses
Prerequisite: Knowledge of Environment and Sustainability

Rationale: Rapid urbanization and population growth in India have amplified the critical need for effective solid waste management, as uncontrolled waste accumulation poses severe threats to public health, environmental integrity, and economic stability; therefore, a comprehensive approach involving waste characterization, efficient collection and transportation, and the implementation of diverse treatment and disposal technologies, including composting, recycling, and sanitary landfills, is essential, requiring engineers to possess a deep understanding of relevant regulations, environmental impact assessments, and community engagement to ensure a sustainable and healthier future..

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
2	0	2	3	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

GYANMANJARI INNOVATIVE UNIVERSITY BHAVNAGAR

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Sources, Composition and properties of Municipal Solid Waste:** Introduction, Sources of solid waste, Types of solid waste, Composition of solid waste and its determination, Types of materials recovered from MSW. Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.	5	20
2	**Generation, Collection, Handling, Separation and Storage of Solid Waste:** Quantities of Solid Waste, Factors affecting solid waste generation rate. Quantities of materials recovered from MSW, 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, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources.	10	30
3	**Processing of Solid Waste**: Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc. Processing of solid waste at Commercial and industrial site.	4	15
4	**Disposal of Municipal Solid Waste:** Combustion and energy recovery of municipal solid waste, effects of combustion, undesirable effects of Combustion., Landfill: Classification, planning, sitting, permitting, landfill processes, landfill design, landfill operation, use Of old landfill, Differentiate sanitary land fill and incineration as final disposal system for solid waste, Biochemical processes: Methane generation by anaerobic digestion, composting and other biochemical Processes.	6	20
5	**Hazardous Solid Waste:** Definition, identification and classification of hazardous solid waste. Characteristics Hazardous waste toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness. 7.2 Bio-medical waste, its source generation, storage, transportation and Disposal.	5	15

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Waste Stream Mapping** Create a waste stream map for the specific location (Max. 5 students) (e.g. a cafeteria, a dormitory, a local business) Create visual map and upload on GMIU Web portal.	10
2	**Recycled Product Design Challenge** Collect a common waste material (plastic bottles, cardboard, used textiles, etc.). In small groups (Max 5 students), design and build a new product using primarily these waste materials. They must then present their product, explain its function, make a PPT and upload on GMIU Web portal.	10
3	**Comparative Analysis of Disposal Technologies** Evaluate the strengths and weaknesses of different MSW disposal technologies by individual student, make a report and upload on GMIU Web portal.	10
	TOTAL	**30**

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	25%	40%	25%	10%	-	-

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.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Explain municipal solid waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies
CO2	Outline sources, types and composition of solid waste with methods of handling, sampling and storage of solid waste.
CO3	Understand about recycle and reuse of solid waste
CO4	Describe methods of disposal of hazardous solid waste.

List of Practical

Sr. No.	Descriptions	Unit No.	Hrs.
01	Determination of Composition and Properties of Municipal Solid Waste	01	04
02	Analysis of Physical and Chemical Properties of MSW Samples	01	04
03	Estimation of Solid Waste Generation Rate and Recovery Potential	02	04
04	Material Separation using Magnets and Electromechanical Separators	02	02
05	Shredding and Compaction Techniques for Solid Waste Processing	03	04
06	Study of Waste Processing Techniques at Commercial Sites	03	02
07	Planning and Design of a Sanitary Landfill System	04	02
08	Methane Estimation in Anaerobic Digestion and Composting Processes	04	02
09	Identification and Classification of Hazardous Solid Waste	05	04
10	Analysis of Bio-Medical Waste Handling, Storage, and Disposal Methods	05	02
TOTAL			**30**

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Integrated solid waste management- George Tchobanoglous and Hillary theisen, Samuel Vigil McGraw Hill

[2] Disposal and recovery of municipal solid waste - Michael E Henstock Butterworths, Ann Arbor Science

[3] Solid waste management- P Aarne Vesilig

[4] Environmental Engineering Mackenzie L Davis, David A Cornwell