



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

w. e. f. Academic Year:	2025-2026
Semester:	4 th
Category of the Course:	Core Courses

Prerequisite:	A good understanding regarding the hazardous waste, its sources and classification is required.
Rationale:	The main objective of this subject is to study the technologies related to the management of hazardous waste. Also, Engineers and professionals working in waste management area could be benefited by this course.

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	Marks % Weightage
CO-01	Understanding the sources of hazardous waste, its management and related Indian legislations.	25
CO-02	Application of different methods for hazardous waste characterization and its transportation.	27
CO-03	Evaluation of proper method for transportation, handling and processing of hazardous waste.	21
CO-04	Understanding the appropriate method for the disposal of hazardous waste.	27

Teaching and Examination Scheme:

Teaching Scheme (in Hours)					Total Credits L+T+ (PR/2)	Assessment Pattern and Marks					Total Marks
L	T	PR	PBL*	TH		Theory		Tutorial / Practical			
					C	ESE (E)	PA (M)	PA(I)	PBL (I)	ESE (V)	
45	00	30	45	120	04	70	00	00	30	50	150



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Sources of Hazardous Waste: Hazardous waste, waste classification, sources, hazardous waste-toxicology and hazardous waste sources / generators. Need for hazardous waste management - elements of integrated hazardous waste management and roles of stakeholders and NGOs - salient features of Indian legislations on management.	11	25
2.	Characterization of Hazardous Waste: Hazardous waste generation rates and variation - Composition, physical, chemical and biological properties of hazardous waste, waste sampling and characterization plan - Source reduction of waste - Recycling and reuse. Labelling and handling of hazardous waste. Transportation of Hazardous Waste- Modes and scope of hazardous waste transportation.	12	27
3.	Processing of Hazardous Waste: Objectives of waste processing - material separation and processing technologies - evaluation of Hospital waste, Treatment, Healthcare waste generation, Segregation and collection, Industrial waste and its treatment.	10	21
4.	Disposal of Hazardous Waste: Waste disposal options - Disposal in landfills - Landfill Classification- Construction and operation of secured landfills- Ocean dumping, Land disposal, Soil remediation. Hazardous waste management, Regulation and Disposal Methods, Waste Minimization.	12	27
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	20	30	10	10	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

References/Suggested Learning Resources:

(a) Books:

1. LaGrega, M.D. Buckingham, P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
2. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997.
3. Ramachandra T.V., Management of Municipal Solid Waste, Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore, 2006.
4. Shah K. L., Basics of Solid and Hazardous Waste Mgmt. Tech. by, Prentice Hall, 1999.
5. Bhatia S.C., Solid and Hazardous Waste Management, Atlantic Publishers & Dist. 2007.
6. S.K. Garg., Environmental Engineering (Volume II – Wastewater Engineering) Khanna Publishers 2018 (Revised & Enlarged Edition)

(b) Open-source software and website:

1. Reference to NPTEL lectures can be made for a better understanding regarding municipal solid waste management, solid and hazardous waste management and integrated waste management for smart city done in industries under different conditions.
2. SWAYAM for Environmental Engineering, Waste Management, and Sustainability courses.
3. Waste Management Simulation - WAMPS (Waste Management Planning System) for Models waste generation, collection routes, and treatment options.

Suggested Course Practical List: (Minimum 6 experiments need to be performed)

1. To carry out the characterization of hazardous waste.
2. To determine the color intensity of dye contaminated water by using spectrophotometer.
3. To study the adsorption of dye from aqueous solution on any adsorbent
4. To determine the electrical conductivity of hazardous waste water.
5. Determination of total solids, volatile solids and fixed solids of waste.
6. To study about the regulations, methods for the disposal of hazardous waste.



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

7. To study about legislations on management and handling of hazardous waste.

8. To prepare material safety data sheet for hazardous w

List of Laboratory/Learning Resources Required:

C.O.D. digester, Flame photometer, Kjeldal assembly, Autoclave, B.O.D. incubator, Double beam spectrophotometer, Micro balance, Conductivity meter, etc.

Suggested Project List:

Sr. No	Name of the Project	Description / Objective
1	Survey of Hazardous Waste Generators	Conduct a survey of nearby industries, hospitals, and laboratories to identify types and quantities of hazardous waste generated. Classify wastes as per CPCB/UN guidelines.
2	Characterization of Hazardous Waste	Collect samples of industrial or biomedical waste and analyze physical, chemical, and biological properties. Prepare a report including handling, labeling, and storage requirements.
3	Design of Secured Landfill for Hazardous Waste	Develop a conceptual design of a secured landfill cell, including liner system, leachate collection, gas management, and operational procedures according to Indian standards.
4	Case Study on CHWTSDF (Common Hazardous Waste Treatment, Storage, and Disposal Facility)	Visit or review an existing facility, analyze treatment methods, storage, transportation, and compliance with safety regulations. Prepare a detailed report.
5	Waste Minimization and Recycling Plan for an Industry	Analyze industrial processes and propose modifications for reducing hazardous waste generation. Suggest reuse/recycling options and evaluate environmental and economic benefits.



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

6	Comparative Study of Hazardous Waste Regulations	Compare Indian Hazardous and Other Wastes Rules, 2016 with international standards (USEPA/EU). Highlight enforcement challenges, gaps, and roles of stakeholders.
7	Industrial / Healthcare Waste Audit	Conduct an audit of waste generation in a small-scale industry or hospital. Suggest proper segregation, treatment, and disposal strategies based on collected data.
8	Public Awareness Project on Hazardous Waste Management	Develop educational materials (posters, videos, workshops) for community awareness on proper handling, segregation, and disposal of hazardous waste.

Suggested Activities for Students:

Sr. No	Name of the Activity	No. of Hours	Evaluation Criteria
1.	Technical site visit / Industry visit (Hazardous Waste Generators / Treatment Facility)	Visit: 5h, Report preparation: 5h, Total: 10h	Based on the report submitted. Report should contain observations, waste classification, treatment methods, and calculations based on industry/lab data.
2.	Technical Video based learning on Hazardous Waste Management	Duration of video: 5h, Report preparation: 5h, Total: 10h	Report/presentation based on video learning outcomes, including regulatory compliance and treatment technologies
3.	Videos on Industrial Safety / Disaster Management related to Hazardous Waste	Duration of video: 5h, Report preparation: 5h, Total: 10h	Based on quiz/report submitted, covering safety practices, labeling, handling, and emergency response.



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

4.	Self-learning online course	Minimum duration of the course should be 10h	Examination-based assessment at the end of course. Based on certificate produced (e.g., NPTEL, SWAYAM, Coursera).
5.	Discussion on research papers related to Hazardous Waste Management	5 research papers: 20h	Summarize research papers and evaluate critical parameters such as waste minimization, treatment technologies, and policy analysis.
6.	Poster/Chart/PowerPoint preparation on Hazardous Waste Topics	Duration: 6h	Based on poster/chart preparation and presentation skills. Topics may include integrated waste management, recycling, or landfill design.
7.	Working / non-working model on Waste Treatment / Recycling Technologies	Working: 12h, non-working: 8h	Based on interdepartmental/external evaluation, innovation, and demonstration of treatment concepts.
8.	Industrial exposure (2-3 days) for hazardous waste assessment	Industrial exposure: 15h, Problem identification & tentative solution: 10h, Total: 25h	Evaluation based on identification of critical problems, suggested solutions, and technical justification.
9.	Group discussion on emerging topics in Hazardous Waste Management	Duration: 1h each	Based on performance in discussion, technical depth, and knowledge of regulations, treatment methods, and safety practices.
10.	Real-world case study analysis	Data collection/study: 5h, Report preparation: 5h, Total: 10h	Based on in-depth study, technical depth, data collected, analysis of treatment/disposal methods, and fact-finding.



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Waste Technology

Course / Subject Code : BE040AB011

Course / Subject Name : Hazardous Waste Management Technology

11.	Expert lecture / session on Hazardous Waste Management	Duration: 2h (lecture) + 2h (report)	Based on proof of attendance and report submitted, highlighting key learnings and applicability to local/regional scenarios
12.	Online Technical Quizzes / Simulations on Hazardous Waste	Multiple quizzes summing up to 10h	Based on quiz scores and reflection report after each quiz, including interpretation of results and application to practical scenarios.
13.	Tech Blog / YouTube Channel Curation on Waste Management	10h (Content curation + Analysis)	Summary report on curated content and learning outcomes, including new technologies, research trends, and regulatory updates.
