# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Civil Engineering**

**Subject Code: ME02065131**

**Subject Name: Solid And Hazardous Waste management**

| | |
|---|---|
| WEF Academic Year: | AY 2024-2025 |
| Semester: | 2 |
| Category of the Course: | Professional Elective Course |

| | |
|---|---|
| **Prerequisite:** | Fundamentals of Environmental process and technique |
| **Rationale:** | To understand the dynamics of environmental system and control the parameters causing deterioration of environment system |

**Course Outcome:**

After Completion of the Course, Student will able to:

| No | Course Outcomes | RBT Level |
|---|---|---|
| CO-1 | Classify sources of solid waste | R,U |
| CO-2 | Understand various physical, chemical and biological characteristics of solid waste and Know the generation rates of various solid waste | U,N,A |
| CO-3 | Describe the major environmental problems caused by inappropriate production and disposal of solid by-products manufacturing and consumption | N,E |
| CO-4 | Analyze the role of regulatory systems in solid & hazardous wastes management | A,C |

**Revised Bloom's Taxonomy (RBT)*

**Course Scheme:**

| Teaching Scheme | | | Total Credits | Assessment Pattern and Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Practical | | |
| L | T | PR | C | ESE (E) | PA(M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Course Content:**

| Sr. No. | Course Content | No. of Hours | % of Weightage |
|---|---|---|---|
| 1 | Introduction: Solid waste sources – Types and sources – Generation rates – Potential of disease – Nuisance and other problems – Need for solid and hazardous waste management – Elements of integrated waste management and roles of stakeholders – Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, electronic wastes, plastics waste. | 7 | 15 |
| 2 | Waste Characterization and Source Reduction: Waste generation rates and variation – Composition, physical, chemical and biological properties of solid wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes - Recycling and reuse | 7 | 15 |
| 3 | Storage, Collection and Transport of Wastes Functional elements of solid waste– Handling and segregation of wastes at source – Collection and separation – Containers and its location – Collection systems and its example – physical, chemical and microbiological characteristics of waste – - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport - Transfer station. | 6 | 15 |
| 4 | Waste Processing Technologies: Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes | 6 | 15 |
| 5 | Waste Disposal<br>Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation | 7 | 15 |
| 6 | Solid & Hazardous Waste Management and standards: Guidelines, Relevant Legislation etc., Standards of collection, Reception, Treatment, Transport, Storage and Disposal as per Environmental | 12 | 25 |

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|---|---|---|---|
| | Protection Act, 1986, Elements of integrated waste management. Economy and financial aspects of waste management. | | |
| | **Total** | **45** | **100** |

**Reference Books:**

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

**List of Experiments:**

1. Study of waste generation, sources and classification all types of wastes.
2. Study of identification and characterization of wastes
3. Collection of data with detail investigation on system of solid waste management and analysis of the system
4. Preparation of report of a city solid waste management system including positive points and lacuna in the present system
5. Study of hazardous waste producing industry with details of points of generation in various forms.
6. Study of manifestation system of particular hazardous waste with processes including handling, storage, transportation and disposal
7. Study on treatment technology of hazardous waste.
8. Study of relevant standards on hazardous waste generation, storage
9. Visit report preparation of a hazardous waste case

**List of Open-Source Software/learning website:**

1. https://nptel.ac.in/

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