GUJARAT TECHNOLOGICAL UNIVERSITY

Environmental Engineering (17)

SOLID & HAZARDOUS WASTE MANAGEMENT
SUBJECT CODE: 2721713
M.E. 2nd SEMESTER

Type of course: Engineering and Technology

Prerequisite: Basic principles of Engineering

Rationale: Designing practical solution of MSW and hazardous waste

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T/P	P	C	Theory Marks		Tutorial/ Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	0	4	70	30	30	0	10	10	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Learning Objectives:

- To impart knowledge on the elements of managing solid wastes from Municipal and Industrial sources including the related engineering principles, design criteria, methods and equipments.

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Sources, Classification & Regulatory Framework** Types and Sources of solid and hazardous wastes - 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, lead acid batteries, electronic wastes, plastics and fly ash – Financing waste management.	6	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 – Waste exchange – Extended producer responsibility - Recycling and reuse	6	15
3	**Storage, Collection And Transport of Wastes** Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation– compatibility, storage, labeling and handling of hazardous wastes – hazardous waste manifests and transport	6	15
4	**Waste Processing Technologies**	6	15

	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		
5	**Waste Disposal** 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	6	15
6	**Solid & Hazardous Waste Management**: Guidelines, Relevant Legislation etc.	2	05
7	Elements of integrated waste management. Economy and financial aspects of waste management. Other Waste Types: Nuclear and Radio Active Wastes.	4	10
8	**Standards Applicable to Generators of Hazardous Wastes** :Standards of collection, Reception, Treatment, Transport, Storage and Disposal as per Environmental Protection Act, 1986	4	10

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 International Edition, New York, 1995.
7. Environmental Law and Policy in India by Rosencranz & Divan & Noble

Course Outcome: After successful completion of the course the students shall be able to

- Understand various physical, chemical and biological characteristics of solid waste
- Know the generation rates of various solid waste
- Describe the major environmental problems caused by inappropriate production and disposal of solid by-products manufacturing and consumption
- Identify and describe the role of various systems of treatment of hazardous wastes
- Classify and model sources of solid wastes
- Apply principles of sustainable development to the management of solid by-products
- Identity design inputs to enable the avoidance, minimization, recycling, re-use and treatment of solid by-products
- Analyze the role of regulatory systems in solid & hazardous wastes management

List of Experiments:

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

Design based Problems (DP)/Open Ended Problem: --

Understanding practical problems of MSW and Hazardous waste and designing most appropriate solution thereof

List of Open Source Software/learning website:

- http://elearning.vtu.ac.in/
- www.nptel.iitm.ac.in/courses/