Syllabus for Master of Technology

Environmental Engineering

Subject Code: 02EN0104

Subject Name: Solid & Hazardous Waste Management

M.Tech Year – I (Semester I)

Objective: The Course aims to expose students for the management of solid and hazardous wastes and production of useful resources.

Credits Earned: 05 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Management of solid wastes generated from industries
2. Development of useful products from solid wastes
3. Characterization of physico-chemical characteristics of solid wastes.

Pre-requisite of course: Basic understanding of the concepts leant in Environmental Sciences and Engineering.

Credits Earned: 05 Credits

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term Work (TW)	
4	2	-	5	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**Basic overview of solid wastes** classification of solid wastes,need of SWM–Introduction to integrated waste management process - Indianlegislations on handling & management of MSW, plastics and hazardous wastes in MSW- Wastes generation rates-National and Global basis.	**6**
2	**Properties of solid wastesand its handling**	**20**

	Composition of solid wastes (physical, chemical and biological) - waste sampling and characterization process–Reduction at source–Reuse & Recycling- Source reduction of wastes, Toxic waste: -Composition, classification, nature of solid wastes, impacts of waste in MSW.Handling of wastes at source - storage &collection of MSW - Analysis of Collection methods - Need for transfer and transport - Transfer stations	
3	**Management of solid wastesand utilization** Aim & Objectives of waste treatment - material segregation and processing methodology–types of conversion methodology – Concept of 4R in managing MSW-Waste disposal options: - Landfills - Its Classification, types and methods –factors for site selection, design &operation of sanitary landfills,secure landfills. Control methods of landfill gas– method of landfill closure and environmental monitoring - closure of landfills& post closure monitoring rules - landfill remediation- Bioremediation of solid wastes.	**20**
4	**Recent advancement in solid waste management** Case studies on solid waste management around the world by employing sophisticated technologies-feasibility of executing state of the art technologies of handling and managing solid wastes in Indian scenario-solid waste to fuel production.	**05**
5	**Seminar Talk by the students and resource persons**	**05**
	Total	**56**

List of Tutorials

1. Solid wastes sources, types and generation rate
2. Characterization of solid wastes and physico-chemical properties
3. Transportation and handling of solid wastes
4. Haul container and stationary container system.
5. Solid waste generation and its projection scenario
6. Sanitary land filling system its design and case study analysis
7. Composting system of various types' solid wastes.
8. Processing of solid wastes

Design based Problems (DP)/Open Ended Problem:

1. Students will be given actual solid wastes materials for its characterization.
2. Case study analysis of state of the art solid waste management process.

Reference Books :

1. George Tchobanoglouset.al.,*"Integrated Solid Waste Management",* McGraw-Hill Publishers, 2003.
2. Bilitewski.B, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, *"Waste Management",* Springer, 2004.
3. *"Manual on Municipal Solid Waste Management"*, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2010.
4. Landreth.R.E. and Rebers.P.A., *"Municipal Solid Wastes – problems and Solutions",* Lewis Publishers, 2002.
5. Bhide A.D. and Sundaresan.B.B., *"Solid Waste Management in Developing Countries"*, INSDOC, 2003.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	15%	40%	30%	10%	-

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board, may also use any of tools such as collaborative learning, demonstration, role play, Quiz, brainstorming, MOOCs, Active Learning Assignments etc.
b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

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