AC –20/5/2025
Item No. – 6.57 (N) 6

As Per NEP 2020

University of Mumbai

Syllabus for Minor Vertical 2		
Faculty of Engineering		
Board of Studies in Chemical Engineering		
Second Year Programme in Minor (Chemical Engineering) Pollution and Waste Management Technologies		
Semester	IV	
Title of Paper (Theory)	Sem.	Total Credits 4
I) Solid Waste Management	IV	3
Title of Paper (Lab)		Credits
I) Solid Waste Management Lab	IV	1
From the Academic Year		2025-26

Sem. – IV

Pollution and Waste Management Technologies

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MDC 401	Solid Waste Management	3		-	3	-	-	3

Course Code	Course Name	Theory							Total
		Internal Assessment (IAT)			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	IAT-I + IAT-II (Total)					
MDC 401	Solid Waste Management	20	20	40	60	2			100

Course Objectives: 1 to 6

1. To provide in depth knowledge of solid waste management.
2. To provide in depth knowledge of municipal solid waste management storage, collection and tranport of municipal solid waste
3. To provide in-depth knowledge of treatment of municipal solid waste
4. To provide in-depth knowledge of biomedical solid waste
5. To provide in-depth knowledge of industrial waste management and E-waste management
6. To recognize the legal aspects used for solid waste management

Course Outcomes: 1 to 6

On completion of the course the students will:

1. Understand fundamentals of solid waste management
2. Understand storage, collection and transportation of municipal solid waste
3. Understand various treatment methods of municipal solid waste
4. Understand various aspects of biomedical solid waste
5. Understand industrial waste management and E-waste management
6. Learn legal aspects for solid waste management

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Fundamentals of solid waste management**	Definition of solid waste, domestic waste, commerical waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, Sources of solid waste, hazardous and nonhazardous waste Impact of solid waste on environment and human beings Factors affecting solid waste generation Solid waste managemnt techniques: solid waste management hierarchy, waste prevention and waste reduction	7	CO1
II	**Storage, collection and transportation of Municipal Solid Waste**	Sources of municipal solid waste, collection methods of municipal solid waste, tools and equipments used : Litter bin, broom, shovels, handcarts, mechanical road sweepers, community bin movable and stationary Transportation of municipal waste using transport vehicles , capacity and working such as animal carts, auto vehicals, tractors or trailers, trucks, dumpers, compactors. Transfer station meaning, necessity and location Role of rag pickers and their utility for society	6	CO2
III	**Treatment methods Municipal Solid Waste**	Composting definition, principals, factors affecting composting process, methods of composting (manual, mechanical and vermicomposting) Land filing techniques, factors to be considered for site selection, land filling methods area, trench and ramp methods) Leachates and its control, biogas from landfill Advantages and disadvantages of landfill Incineration of waste: introduction, types of incinerators (flash, multiple chamber), incineration process products and their use, Advantages and disadvantages of incineration process Pyrolysis definition and methods Recycling of Municipal Solid Waste	7	CO3
IV	**Biomedical waste management**	Definition, sources and generation of Biomedical waste, Classification of Biomedical waste and management technologies Health aspects during handling and processing, health problems during time of segregation, recovery, recycling and reuse of solid waste, public involvement and participation in Biomedical waste management	7	CO4
V	**Industrial waste management and E-waste management**:	Different types of industrial wastes, collection and disposal of industrial wastes, control measurements for industrial waste, recycling of industrial wastes. E-waste management definition, varieties of E-waste, dangers of E-waste, recycling and disposal of E-waste	6	CO5

VI	**Legal aspects of solid waste management**	Legal aspects: present scenario Muncipal solid waste management rules, 2016 Biomedical waste management rules, 2016 E-waste management rules, 2016 Consruction and demolition waste management rules, 2016 Hazardous and other t waste management rules, 2016 Plastic waste management rules, 2016 Role of Central Pollution Control Board and Maharashtra Pollution Control Board in management of solid waste from various sources	6	CO6

Text Books/ References:

1. Tchobanoglous G., Theisen H. and Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill International editions.
2. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
3. "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India.
4. Management and Handling Rules for: municipal solid waste, biomedical waste, hazardous waste and radioactive wastes, Government of India Publications.
5. Solid Waste Management Hand Book – Pavoni

Assessment:

Internal Assessment (IA) for 20 marks each:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of the syllabus content must be covered in the IAT-I and the remaining 40% to 50% of the syllabus content must be covered in the IAT-II.

End Semester Theory Examination:

- **Question paper format**

  - Question Paper will comprise a total of **six questions each carrying 15 marks Q.1** will be **compulsory** and should **cover the maximum contents of the syllabus**

  - **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

  - A total of **four questions** need to be answered

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MDL401	Solid Waste Management Lab	-	2	-	-	1	-	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment (IAT)			End Sem. Exam			
		IAT-I	IAT-II	IAT-I +IAT-II (Total)				
MDL401	Solid Waste Management Lab	--	--	--	--	25	25	50

Lab Objectives: Students should be able……

1. To gain knowledge of solid waste management
2. To gain knowledge of municipal waste storage and handling and transportation process
3. To gain knowledge of municipal waste treatment methods
4. To gain knowledge of biomedical waste management
5. To gain knowledge of industrial waste and E-waste treatment management
6. To gain knowledge of various legal aspects for solid waste management

Lab Outcomes: (On completion of the course the students will be able to…

1. Understand in depth solid waste management
2. Understand in depth municipal waste storage and handling and transportation process
3. Understand in depth municipal waste treatment methods
4. Understand in depth biomedical waste management
5. Understand in depth industrial waste and E-waste treatment management
6. Understand in depth legal aspects of solid waste management

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs	LO Mapping
0	**Prerequisite**	Knowledge of environment in general	2	
		Knowledge of different types of wastes	2	
1	Basics of Solid waste Management	Demonstration of specific documentary, films or animated film related to solid waste management and submit observations along with comments and future strategies for future solid waste management.	2	LO1

2	Storage, handling and transportation of Municipal Solid Waste	i) Prepare flow chart, write observations, comments based on storage and handling of municipal solid waste in Indian conditions with demonstration of specific documentary, films or animated film related to municipal waste management. ii) Mechanical methods with or without compaction, economy in transportation of waste optimization of transportation routes observations and comments based on related demonstration of specific documentary, films or animated film.	2	LO2
3	Mechanical Methods, Composting and its methods, Landfill Methods	i) Write observations and comments based on composting and its methods based on related demonstration of specific documentary, films or animated film. ii) Write observations and comments based on landfill methods based on related demonstration of specific documentary, films or animated film	2	LO3
4	Biomedical Waste Handling of Biomedical waste and Health aspects	i) Write observations and comments based biomedical waste treatment methods based on related demonstration of specific documentary, films or animated film. ii) Study of health aspects during handling and processing biomedical waste	2	LO4
5	Industrial Solid Waste Management	i) Write observations and comments based on industrial solid waste management related demonstration of specific documentary, films or animated film. ii) Write observations and comments based on related demonstration of specific documentary, films or animated film for uses of plastic waste in road construction.	2	LO5
6	Solid Waste management for Smart City	Solid waste management for smart city	2	LO6

Text Books/ References:

1. Tchobanoglous G., Theisen H. and Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill International editions.
2. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
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4. Management and Handling Rules for: municipal solid waste, biomedical waste, hazardous waste and radioactive wastes, Government of India Publications.
5. Solid Waste Management Hand Book – Pavoni

List of Experiments.

Week No	List of Experiments	Hrs
01	Demonstration of specific documentary, films or animated film related to solid waste management and submit observations along with comments and future strategies for future solid waste management.	02
02	Prepare flow chart, write observations, comments based on storage and handling of municipal solid waste in Indian conditions with demonstration of specific documentary, films or animated film related to municipal waste management	02
03	Mechanical methods with or without compaction, economy in transportation of waste optimization of transportation routes observations and comments based on related demonstration of specific documentary, films or animated film	02
04	Write observations and comments based composting and its methods based on related demonstration of specific documentary, films or animated film	02
05	Write observations and comments based on landfill methods based on related demonstration of specific documentary, films or animated film	02
06	Write observations and comments based biomedical waste treatment methods based on related demonstration of specific documentary, films or animated film	02
07	Study of health aspects during handling and processing biomedical waste	02
08	Write observations and comments based on industrial solid waste management related demonstration of specific documentary, films or animated film	02
09	Write observations and comments based on related demonstration of specific documentary, films or animated film for uses of plastic waste in road construction	02
10	Solid waste management for smart city	02

Assessment:

Term Work: Term Work shall consist of at least 8 to 10 practicals based on the above list**Internal Practical Exam:** Conduct an practical exam after completing the six modules of the course to assess and ensure the learner's understanding.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Internal Practical Exam) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

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