

**MOTHER TERESA WOMEN'S UNIVERSITY**  
**KODAIKANAL - 624 101**  
**Tamil Nadu.**



UGC-Non-SAP, DST-CURIE and DST-FIST Assisted

**DEPARTMENT OF BIOTECHNOLOGY**

**Curriculum Framework and Syllabus for**

**Diploma in Waste Management**

**(For the candidates to be admitted from the academic year 2021-2022 onwards)**

**(UNDER CHOICE BASED CREDIT SYSTEM- CBCS)**

# Curriculum Framework and Syllabus for Diploma in Waste Management

(For the candidates to be admitted from the academic year 2021-2022 onwards)

(UNDER CHOICE BASED CREDIT SYSTEM- CBCS)

## PREAMBLE

Mother Teresa Women's University, whose foundation stone was laid by St. Mother Teresa herself, stands as an epitome of Women empowerment. The University stands as the first and the only Women's University in the State, and the third University in the Nation. With emphasis on research, supported by strong postgraduate programs in various disciplines, the University fosters high quality research activities in various disciplines at M.Phil. and Ph.D. levels.

Department of Biotechnology was started in 2002 with a vision to make an impact through research and technology based training. It is DST Curie, DST-FIST and UGC-Non-SAP sponsored Department. Skill and Employability based curriculum is the specialty of M.Sc Biotechnology.

## Regulations:

**1. Qualification:** Any graduate (science) from Mother Teresa Women's University or any other university accepted by the syndicate or equivalent or any diploma awarded by the Board of Technical Education of any State Government or Central Government.

**2. Duration of the course:**

The course of the professional Diploma in Waste Management shall consist of six months duration. A total of 120 contact Hours (20 Hours per paper).

**3. Medium of Instruction:** English

**4. Subject of Study:** As given in Appendix A

**5. Eligibility of the degree:**

A candidate shall be eligible for the professional Diploma in Waste Management, she has to satisfactorily undergone the prescribed course of study for a period of not less than one year and passed examinations in all papers.

**6. Examinations:**

The examinations shall be three hours duration to each paper at the end of the year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

**7. Passing Minimum Marks**

A candidate shall be declared to have passed examinations in theory of study

only if she scores not less than 40 marks out of 100 in the University examinations.

### 8. Classification of Successful Candidates

Candidate who secures not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **FIRST CLASS**. All other successful candidates shall be declared to have passed in **SECOND CLASS**. Candidates who obtain 75% in **FIRST CLASS WITH DISTINCTION** provided they pass all the examinations prescribed for the course in the first appearance.

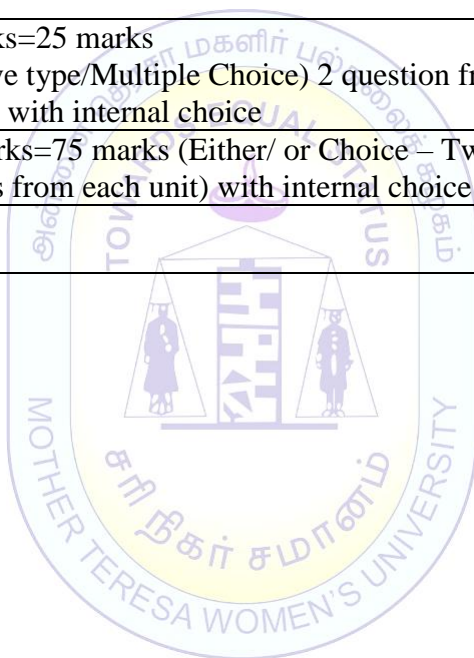
### 9. Question Paper Pattern:

**TIME: 3 hours**

**Max.marks: 100**

Part A	5x5 marks=25 marks (Objective type/Multiple Choice) 2 question from each unit with internal choice	25 marks
Part B	5x15 marks=75 marks (Either/ or Choice – Two questions from each unit) with internal choice	75 marks
	<b>Total</b>	<b>100 marks</b>

### 10. Credits-Four Credits



MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL-01

**Diploma in Waste Management**  
**SYLLABUS 2021-2022**

S.No.	Subject Code	Title of the paper	Hours	Credit	Internal	External	Max. Marks
1.	D21WMT1	Environmental Chemistry and Pollution	5	4	25	75	100
2.	D21WMT2	Waste Water Treatment Techniques	5	4	25	75	100
3.	D21WMT3	Industrial Pollution and Control	5	4	25	75	100
4.	D21WMT4	Solid Wastes Management	5	4	25	75	100
5.	D21WMP1	Waste Water Analysis -Lab	5	4	25	75	100
6.	D21WMP2	Manure Analysis- – Lab	5	4	25	75	100
			<b>30</b>	<b>24</b>			<b>600</b>

## **DIPLOMA IN WASTE MANAGEMENT**

### **Programme Educational Objectives (PEO)**

- To understand the key concept of waste management
- To sensitize the learners about the problem of waste generation and its impact on environment and human health.
- To familiarize the learners to existing legislation, knowledge and practices regarding Waste Management in the country.
- To build a career in the fields of Environmental Hygiene, Waste Water and Solid Waste Management
- To create clean and green environment for achieving the mission of Swachh Bharat

### **Programme Outcome**

At the end of the program the students will be able

1. To impart detailed knowledge on impact of waste on the environment
2. To characterize the waste and apply the knowledge of laws for municipal solid waste management, for handling of biomedical wastes and for handling of plastic wastes.
3. To enrich knowledge for waste disposal techniques
4. To apply the knowledge of science for effective waste collection and for processing of solid waste
5. To select a suitable methods for waste treatment and can provide treatment flow sheet
6. To develop skills to manage the effluent treatment plant effectively
7. To efficiently manage the composting systems, maintain and operate the aerobic and anaerobic composting process for effective organic waste recycling.
8. To manage construction and operations of landfill facilities, energy recovery systems and management of leachate systems.

### **Programme Specific Outcome (PSO)**

On completion of this program, students will be able to

1. manage all types of waste (liquid and solid) effectively by using suitable technology
2. achieve a zero waste management sites for creating clean environment
3. more familiar with various sources and types of liquid waste and solid waste
4. take up a suitable position in agricultural/Residential/commercial/ industrial sectors of national and international level
5. understand the importance of entrepreneurship and marketing of manure

<b>Course Title &amp; Code</b>	<b>PAPER-I-ENVIRONMENTAL CHEMISTRY AND POLLUTION- D21WMT1</b>		
<b>Semester</b>	<b>Semester- I</b>	<b>Credits:4</b>	<b>Hours/weeks: 5</b>
<b>Cognitive Level</b>	K2: Understand                      K3: Apply		
<b>Learning Objective</b>	<ul style="list-style-type: none"> <li>To learn the chemical process of environment</li> <li>To comprehend the sources and effects of environmental pollution</li> </ul>		
<b>Course Outcomes</b>	Upon completion of this course the students will be able to		
	<b>CO1</b>	understand the chemical process of hydrosphere	<b>K2</b>
	<b>CO2</b>	gain knowledge on chemical nature of air and soil	<b>K2</b>
	<b>CO3</b>	attain knowledge on water pollution sources and effects	<b>K2</b>
	<b>CO4</b>	know the land pollution effects	<b>K2</b>
<b>CO5</b>	learn about environmental legislation and able to apply	<b>K3</b>	
<b>Unit I</b>	<b>Water Chemistry:</b> Segments of Environment, Hydrosphere, Water Resources, Water cycle, Physical and chemical properties of water and their environmental significance; water quality standards; Need of water recycling. CPCB norms for discharge of waste water from industries.		
<b>Unit II</b>	<b>Air &amp; Soil Chemistry:</b> Structure of the atmosphere, Chemical composition of atmosphere, photochemical reactions in the atmosphere - formation of smog, acid rain, Greenhouse gases. El Niño. Structure of lithosphere, – physical and chemical properties of soil. Organic matter in soil, soil pH – Macro and micro nutrients.		
<b>Unit III</b>	<b>Water Pollution:</b> Sources and effects of water pollution, Classification of water pollutants - Oxygen demanding wastes, pathogens, water borne diseases, Eutrophication. Thermal pollution, oil pollution, sources and effects of oil pollution.		
<b>Unit IV</b>	<b>Land Pollution:</b> Sources, types and nature of solid wastes, effects of solid wastes, solid industrial wastes, defecation and its effects, fertilizer pollution, types of fertilizers field run off-effects. Pesticides pollution- history, types - effects of pesticides.		
<b>Unit V</b>	<b>Environmental Legislation-</b> Environment protection Act, Water (Prevention Control of Pollution) Act, 1974- Environment (Protection) Act, 1986- Bio-Med Waste (Management & Handling) Rules, 1998- Recycled Plastics Manufacture Usage Rules, 1999.		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>De., A.K., Environmental Chemistry, 4th ed., New Age International (P) Limited, New Delhi 2001.</li> <li>Rao. C.S., Environmental Pollution Control Engineering, New Age International (P) Limited, New Delhi, 1991.</li> </ol>		

<b>References</b>	<ol style="list-style-type: none"> <li>1. Environmental Chemistry, B.K.Sharma., Krishna Prakashan Media (P)Limited,2019</li> <li>2. John Rieuwerts, The Elements of Environmental Pollution,Publisher Routledge, 2015</li> <li>3. Moayad N. Khalaf, Green Polymers and Environmental Pollution Control, Publisher Apple Academic Press, 2021</li> <li>4. Pallavi Saxena, Anju Srivastava, Air Pollution and Environmental Health, Publisher Springer,2020.</li> <li>5. Mark L. Brusseau, Ian L. Pepper and Charles P. Gerba,Environmental and Pollution Science,Publsiher Elsevier,2019</li> </ol>
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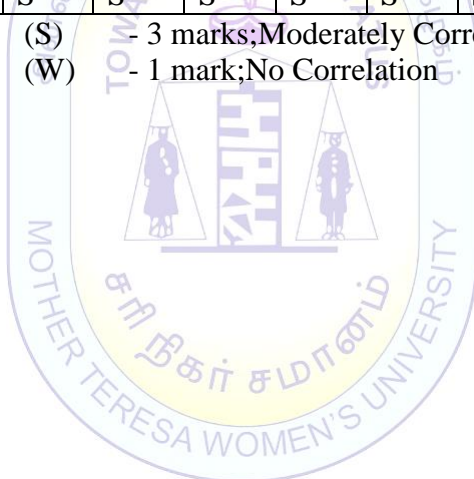
**Mapping of COs with POs &PSOs:**

CO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	S	S	S	M	S	M	M	S	S	S	M	S
CO2	S	S	S	S	S	S	M	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating  
Weakly Correlating

(S) - 3 marks; Moderately Correlating  
(W) - 1 mark; No Correlation

(M) - 2 marks  
(N) - 0 mark



<b>Course Title &amp; Code</b>	<b>PAPER-II-WASTE WATER TREATMENT TECHNIQUES- D21WMT2</b>		
<b>Semester</b>	<b>Semester- I</b>	<b>Credits:4</b>	<b>Hours/weeks: 5</b>
<b>Cognitive Level</b>	K2: Understand    K3: Apply    K4: Analyze    K5: Create		
<b>Learning Objective</b>	<ul style="list-style-type: none"> <li>• To understand the basics of waste water treatment</li> <li>• To gain thorough knowledge on primary, secondary and tertiary treatment of waste water treatment</li> <li>• To get employability in ETP</li> </ul>		
<b>Course Outcomes</b>	Upon completion of this course the students will be able to		
	<b>CO1</b>	know the water quality standards and water treatment methods and can create ETP	<b>K5</b>
	<b>CO2</b>	gain knowledge on primary and secondary treatment process	<b>K2</b>
	<b>CO3</b>	gain knowledge on tertiary treatment techniques	<b>K2</b>
	<b>CO4</b>	learn the techniques used for sludge disposal	<b>K2</b>
	<b>CO5</b>	analyse the biotechnological methods for hazardous waste management and able to work in ETP as manager	<b>K4</b>
<b>Unit I</b>	Water demand, potable water purification processes in natural and engineered Systems. Water quality standards national and international, production of purified drinking water from industries.		
<b>Unit II</b>	Wastewater Treatment - Flow – Sheets: Unit operations and unit processes , Primary treatment, Pre – treatment : Screening – bar racks, Grit removal, Communication, Flow – equalization., Sedimentation : Design concepts, Secondary treatment : Chemical unit processes: Precipitation, Coagulation, Disinfection Process design , Biological unit processes : nature and kinetics of biological growth : Aerobic process – activated sludge system, trickling filters , Anaerobic process – CSTR, Anaerobic Filters, UASB Oxidation ponds Process design.		
<b>Unit III</b>	Advanced Waste water treatment, methods, principles and process description. Membrane filtration, Gas stripping, Ion exchange, Advanced Oxidation Process (AOP): Sewage water treatments systems-STP-principle and unit process.		
<b>Unit IV</b>	Water reclamation and reuse: Water reclamation technologies – process flow diagrams; Agricultural and landscape irrigation; ground water recharge with reclaimed water – ground water recharge guidelines; Risk assessment for water reuse, Industrial water reuse: Cooling tower makeup water.Sludge disposal: Sources and effects of sludge on environment. Methods of sludge disposal. Biotechnological approaches for waste water treatment,		
<b>Unit V</b>	Biotechnological application of hazardous waste management and management of Resources: bioremediation, phytoremediation, Use of microbial systems,Waste water treatment using root zone treatment by plants,Reclamation of wasteland.		



<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. B.K.Sharma, Water Pollution, Krishna Prakashan Media (P) Ltd,2000.</li> <li>2. Abbasi, S. A. Environmental Pollution and its Control. Cogent International, Pondicherry. 1998</li> <li>3. 2. Abbasi, S. A. and Ramasamy, E. V. Biotechnological Methods of Pollution Control. Universities Press (India) Limited, Hyderabad.1999.</li> </ol>
<b>References</b>	<ol style="list-style-type: none"> <li>1. Metcalf and Eddy, Wastewater Engineering: Treatment And Reuse, Publis McGraw Hill Education,2017.</li> <li>2. B.K.Sharma, Environmental Pollution, Krishna Prakashan Media (P)Limited,2019</li> <li>3. Adrianus van Haandel, Jeroen van der Lubbe,Handbook of Biolog Wastewater Treatment, IWA The International Water Associat Publishing,2012</li> <li>4. Maulin Shah,Angana Sarkar,Sukhendu Mandel,Wastewa Treatment,Publisher Elsevier,2021</li> <li>5. P.N.Modi,Sewage Treatment &amp; Disposal &amp; Waste Water Engineering,Rajs Publications,2015</li> </ol>

#### Mapping of COs with POs &PSOs:

CO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	M	S	S	M	S	M	M	S	S	S	M	S
CO2	M	S	S	S	M	S	M	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating (S) - 3 marks; Moderately Correlating (M) - 2 marks  
 Weakly Correlating (W) - 1 mark; No Correlation (N) - 0 mark

Course Title & Code	I-PRACTICAL IN WATER AND WASTE WATER ANALYSIS- D21WMP1		
Semester	Semester- I	Credits:4	Hours/weeks: 5
Cognitive Level	K2: Understand      K3: Apply		
Learning Objective	<ul style="list-style-type: none"> <li>To know the sampling techniques of water</li> <li>To learn the methods of water quality analysis</li> <li>To become skilled at the techniques of waste water sampling, analysis and handling the equipments</li> </ul>		
Course Outcomes	Upon completion of this course the students will be able to		
	CO1	practice proper water sampling techniques	K2
	CO2	gain knowledge on principle and mechanism of equipments used for waste water analysis	K2
	CO3	perform water quality analysis and compare with water quality standards for recommendation	K3
	CO4	practice waste water analysis and adopt suitable techniques for treatment	K3
CO5	understand the basic concept of water and waste water analysis	K2	
Experiments	<ol style="list-style-type: none"> <li>Sampling techniques of water and waste water</li> <li><b>Physical parameters:</b> pH, temperature, electrical conductivity, turbidity.</li> <li><b>Chemical parameter:</b> Total solids, total dissolved solids, Total suspended solids, alkalinity, acidity, total hardness, calcium, magnesium, chloride, Fluoride, Cr, Hg, Dissolved oxygen, BOD &amp; COD.</li> <li><b>Nutrient parameters:</b> nitrates, phosphates, sodium, potassium, silicates, sulphates (one water sample and two available effluent samples are to be analysed).</li> </ol>		
References	<ol style="list-style-type: none"> <li>APHA –Standard methods for Water/Waste Water Analysis-2001</li> <li>Shun Dar Lin, Water and Wastewater Calculations Manual, Mac Graw Hill Publication, 2014</li> <li>1. Anand Dev Gupta, Hand Book of Water, Air and Soil Analysis, Publisher: International E – Publication, 2014</li> <li>Russell, Practical Wastewater Treatment, Wiley Publication, 2019</li> </ol>		

#### Mapping of COs with POs & PSOs:

CO	PO					PSO						
	1	2	3	4	5	1	2	3	4	5	6	7
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	M	S
CO4	S	S	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	S	S	S	S	S	S	N	M

Strongly Correlating (S)      - 3 marks      Moderately Correlating (M)      - 2 marks  
 Weakly Correlating (W)      -1 mark      No Correlation (N)      - 0 mark

Course Title & Code	Semester II PAPER-III-INDUSTRIAL POLLUTION AND ITS CONTROL- D21WMT3		
Semester	Semester- II	Credits:4	Hours/weeks: 5
Cognitive Level	K2: Understand K3: Apply K5:Create		
Learning Objective	<ul style="list-style-type: none"> <li>To learn the importance of industries</li> <li>To acquire knowledge on manufacturing and treatment process of various industries</li> <li>To develop skill to become ETP manager</li> </ul>		
Course Outcomes	Upon completion of this course the students will be able to		
	CO1	acquire knowledge on economic importance of industries	K2
	CO2	know about the manufacturing and treatment process of Tanneries, sugar and distilleries industries	K2
	CO3	acquire skill for the treatment of paper and pulp industries and tanneries	K2
	CO4	apply the learned skill for the control of pollution from cement industries	K3
	CO5	learn the technologies for creating effective treatment techniques in fertilizer and pharmaceutical industries	K5
Unit I	Importance of industries - Indian scene –Classification of Industries, Availability of the Raw materials and their transportation, solid, liquid and gaseous raw materials.		
Unit II	Tanneries: Production of leather, vegetable tanning and chrome tanning processes. Sources and characteristics of wastes. Effect of tannery effluent and other wastes on receiving bodies and treatment methods of the wastes. Sugar mills and Distilleries - their manufacturing processes, sources and characteristics of their wastes. Treatment.		
Unit III	Paper and pulp mills manufacturing processes, sources and characteristics of wastes. Effect of wastes. Treatment processes. Textile mills and dye industry-manufacturing processes, sources and characteristics of wastes. Effects of the wastes on receiving bodies. treatment of the wastes. Oil refineries-sources and effects, effluent treatment process.		
Unit IV	Cement industries - manufacturing process, sources of pollution and wastes. Effect of wastes. Control technique of pollution. Oil refineries and thermal power plant processes involved. Sources of pollution characteristics of pollutants and their effects. Pollution control techniques.		
Unit V	Fertilizer industries: manufacturing processes, sources and characteristics of wastes and their effects. Treatment processes. Pharmaceutical plants: manufacturing processes sources and characteristics of wastes and their effects and Treatment. Steel plant: sources and effects of effluent and treatment process		
Text Books	<ol style="list-style-type: none"> <li>M.N. Rao and Dutta , Waste Water Treatment, Oxford &amp; IBH, New Delhi.2009.</li> <li>B.K.Sharma, Environmental Chemistry, Krishna Prakashan Media(P)Limited, 2019.</li> </ol>		

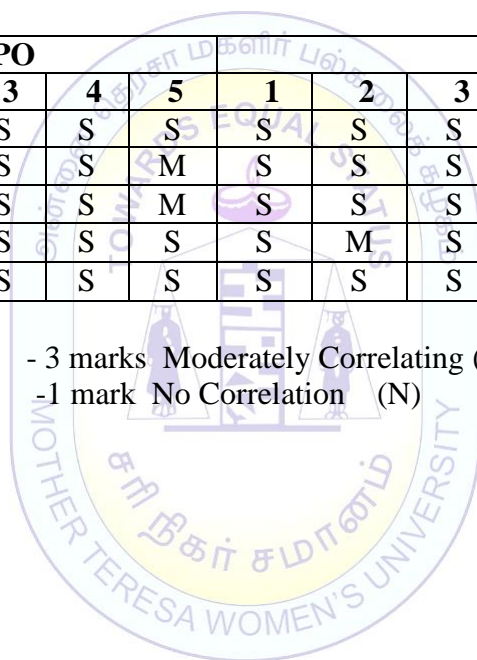
<b>References</b>	<ol style="list-style-type: none"> <li>1. Met Calf and Eddi, waste water engineering, Mc Graw hill publications, New Delhi, India. 1979</li> <li>2. Mark J. Hammer and Mark J. Hammer (Jr) , Water and Waste Water technology, Prentice Hall, New York.2008.</li> <li>3. Matthew R. Fisher, Environmental Biology, Open Oregon Educational Resources,2019.</li> <li>4. J P F D'Mello,A Handbook of Environmental Toxicology, Publisher : CABI Publication,2019.</li> <li>5. Edward A. Laws,Environmental Toxicology, Springer Publication,2013.</li> </ol>
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**Mapping of COs with POs & PSOs:**

CO	PO					PSO							
	1	2	3	4	5	1	2	3	4	5	6	7	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	M	S	S	S	S	S	S
CO5	S	M	S	S	S	S	S	S	S	S	N	M	M

Strongly Correlating (S)  
Weakly Correlating (W)

- 3 marks Moderately Correlating (M) - 2 marks  
-1 mark No Correlation (N) - 0 mark



Course Title & Code	PAPER-IV- SOLID WASTE MANAGEMENT- D21WMT4		
Semester	Semester- II	Credits:4	Hours/weeks: 5
Cognitive Level	K2: Understand                      K3: Apply		
Learning Objective	<ul style="list-style-type: none"> <li>To acquire deep knowledge in solid waste management</li> <li>To learn the treatment techniques for the scientific disposal of solid waste</li> </ul>		
Course Outcomes	Upon completion of this course the students will be able to		
	CO1	obtain a deep knowledge in solid waste collection and transport	K2
	CO2	know about resource recovery from solid waste	K2
	CO3	learn the landfill techniques to apply in the field	K3
	CO4	apply the knowledge to identify the hazardous waste	K3
CO5	learn the techniques for biomedical waste disposal	K2	
Unit I	<b>Municipal Solid Waste Management</b> : Introduction, Waste Generation India-abroad, Sources, reduction of solid waste, Hazardous Wastes (Handling and Management) Rules 1998,5R concepts, methods of solid waste collection, composition and properties, sampling and characterization,		
Unit II	<b>Processing &amp; Recovery:</b> storage and processing including segregation, transfer and transport, handling equipments, Processing techniques:purpose of processing,volume reduction by incineration, process description, mechanical volume reduction (compaction), mechanical size reduction (shredding), component separation (manual and mechanical methods) .Recovery and recycling of useful solid wastes, Recovery of biological conversion products: Compost (Composting and Vermi compost) and Biogas. Incineration and energy recovery. . Municipal solid waste rules..		
Unit III	<b>Land disposal of solid waste;</b> Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation		
Unit IV	<b>Hazardous Waste Management:</b> Introduction Definitions and identification, Sources and characteristics, Impacts, transportation – modes and regulations, control, minimization –compatibility, handling and storage and recycling.		
Unit V	<b>Biomedical and chemical wastes-</b> Biomedical wastes – Types – handling – control of biomedical wastes-Disposal methods. Chemical wastes – Sources – Industrial - Inorganic pollutants – effects – Need for control – Treatment and disposal techniques – Physical, chemical and biological processes – Health and environmental effects.		
Text Books	<ol style="list-style-type: none"> <li>Gupta.D.K, Sonarkar, Nimbalkar, Solid waste Management,2010.</li> <li>Bhide and Sundaresan, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. 2000.</li> <li>Gupta.D.K, Sonarkar, Nimbalkar, Solid waste Management,2010.</li> <li>Bhide and Sundaresan, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. 2000.</li> </ol>		

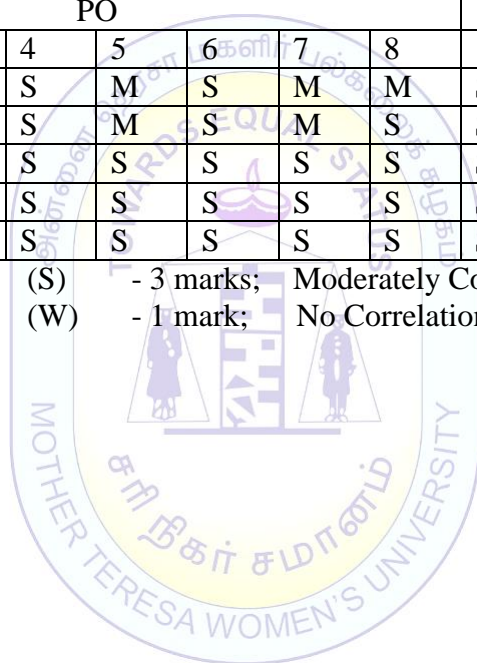
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. John Pichtel, Waste Management Practices, CRC Press, Taylor and Francis Group 2005.</li> <li>2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 2010.</li> <li>3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 2008.</li> <li>4. Lie, D.H.F. and Liptak, B.G. Hazardous Wastes and Solid Wastes- Lewis publishers, New York. 2000.</li> <li>5. La Grega, M.D., Buckingham, P.L. and Evans J.C.Hazardous Waste Management, II Ed, , Mc Graw HillInc., 2001.</li> </ol>
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**Mapping of COs with POs &PSOs:**

CO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	M	S	S	M	S	M	M	S	S	S	M	S
CO2	M	S	S	S	M	S	M	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M	S	S	S

Strongly Correlating  
Weakly Correlating

(S) - 3 marks; Moderately Correlating (M) - 2 marks  
(W) - 1 mark; No Correlation (N) - 0 mark



<b>Course Title &amp; Code</b>	<b>II-PRACTICAL IN MANURE ANALYSIS AND WASTE MANAGEMENT- D21WMP2</b>		
<b>Semester</b>	<b>Semester- II</b>	<b>Credits:4</b>	<b>Hours/weeks: 5</b>
<b>Cognitive Level</b>	K1: Recall    K2: Understand    K4:Analyze		
<b>Learning Objective</b>	<ul style="list-style-type: none"> <li>To learn the techniques of manure analysis</li> <li>To analyse the solid waste and select a suitable technology for solid waste management</li> </ul>		
<b>Course Outcomes</b>	Upon completion of this course the students will be able to		
	<b>CO1</b>	perform the compost analysis	<b>K4</b>
	<b>CO2</b>	identify the composition of solid waste	<b>K3</b>
	<b>CO3</b>	classify the solid waste	<b>K3</b>
	<b>CO4</b>	suggest suitable techniques	<b>K2</b>
<b>CO5</b>	prepare a plan to establish a compost yard	<b>K3</b>	
<b>Experiments</b>	<ol style="list-style-type: none"> <li>Compost analysis- pH, EC determination, alkalinity, acidity, nitrate, phosphate, potassium, sulphate, organic matter</li> <li>Survey the composition of solid waste from a village and a town</li> <li>Survey the MSW of your locality and identify its sources and write composition of MSW.</li> <li>Survey your locality and based on it suggest methods of solid waste collection.</li> <li>Survey your locality and based on it suggest suitable methods of handling, separation and storage of solid waste.</li> <li>Field trip to municipal solid waste/zero waste management sites/ Biomedical waste plant.</li> <li>Draw a flow sheet for distillery and sugar effluent treatment</li> <li>Plan and draw a suitable flowsheet for dyeing industry and pharmaceutical industry effluent treatment</li> <li>Draw a flowsheet for sewage treatment</li> <li>Visit an ETP of industry and sewage treatment plant and prepare a report</li> </ol>		
<b>References</b>	<ol style="list-style-type: none"> <li>Anand Dev Gupta, Hand Book of Water, Air and Soil Analysis, Publisher: International E – Publication, 2014.</li> <li>Salman Tomaizeh, Soil Science Manual Lab, Publisher: Hebron University, 2015.</li> <li>K. H. Head, Roger Epps, Manual of Soil Laboratory Testing, Publisher Whittles Publishing, 2014.</li> <li>Central Public Health Environmental Engineering, Manual on Municipal Solid waste analysis, CPHEEO,2016</li> </ol>		

**Mapping of COs with POs &PSOs:**

CO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	M	S	M	M	S	S	M	M	S	M	M	M	M
CO2	S	S	S	S	S	S	S	S	S	S	M	S	S
CO3	M	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S

Strongly Correlating (S) - 3 marks; Moderately Correlating (M) - 2 marks  
 Weakly Correlating (W) - 1 mark; No Correlation (N) - 0 mark

