जे. सी. बोस विज्ञान एवं प्रौद्योगिकी विश्वविद्यालय, वाए.एम.सी.ए, फरीदाबाद
J.C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA
SECTOR -6, MATHURA ROAD, FARIDABAD, HARYANA-121006
(Established vide Haryana State Legislative Act No. 21 of 2009)
'A+' GRADE NAAC Accredited
DEPARTMENT OF ENVIRONMENTAL SCIENCES

Lesson Plan

Faculty Name: Dr. Renuka Gupta **Academic Year: 2025-2026**
Department: Environmental Sciences **Semester/Year: MSc EVS 3rd Sem**
Subject: Solid and Hazardous Waste Management **Subject Code: ESP-203-V**

Topic No.	Topics to be Covered	Teaching Aids	No. of Lectures / Hours Required	Text / Ref. Books/Web Resources	CO Mapping
UNIT-I: MUNICIPAL SOLID WASTE					
1	Municipal Solid Waste-Introduction	BB & PPT	1	R1 & R9	CO1
2	Solid wastes: Definition, types, sources	BB & PPT	1	R1 & R9	CO1
3	Solid wastes: Classification, characteristics of solid waste	BB & PPT	2	R5 & R9	CO1
4	Waste generation rate	BB	1	R1 & R9	CO1
5	Collection and storage of municipal solid wastes, transfer stations	BB & PPT	2	R1 & R3	CO1
6	Waste processing- volume and size reduction	BB & PPT	2	R1 & R3	CO1
7	Waste processing- source reduction, recycling, waste minimization	BB & PPT	1	R1 & R3	CO1
UNIT-II: WASTE TREATMENT AND DISPOSAL					
8	Waste processing technologies-Introduction	BB	2	R2 & R3	CO2
9	Incineration, Combustion	BB & PPT	1	R2 & R3	CO2
10	Stabilization, Solidification, chemical fixation, encapsulation	BB & PPT	1	R2 & R3	CO2
11	Composting, Vermicomposting	BB & PPT	2	R2, R3 & R5	CO2
12	Energy from waste – Bio-gasification	BB & PPT	1	R2, R3 & R5	CO2
13	Anaerobic digestion, pyrolysis	BB & PPT	2	R5	CO2
14	Refuse derived fuel	BB & PPT	1	R2 & R5	CO2
15	Burning, open dumping- problems	BB	1	R9	CO2
16	Landfill – site selection	BB & PPT	1	R3 & R9	CO2
17	Sanitary and secured – structure, design, construction, operation and closure	BB & PPT	1	T3 & T9	CO2

18	Landfill leachate and gas management	BB & PPT	1	R3 & R9	CO2
19	Landfill bioreactors	BB & PPT	1	R3 & R9	CO2
UNIT-III: HAZARDOUS WASTE MANAGEMENT					
20	Hazardous waste: Definition, sources	BB	1	R7 & R9	CO3
21	Hazardous waste: Classification, collection, segregation	BB & PPT	1	R7 & R9	CO3
22	Hazardous waste: Characterization, Treatment and disposal	BB & PPT	2	R7 & R9	CO3
23	Radioactive wastes: Definition, sources	BB & PPT	1	R5, R7 & R9	CO3
24	Radioactive wastes: Classification, collection, segregation	BB & PPT	1	R5, R7 & R9	CO3
25	Radioactive wastes: Treatment and disposal	BB & PPT	1	R5, R7 & R9	CO3
26	E waste: Definition, sources, classification	BB & PPT	1	R4 & R8	CO3
27	E waste: Classification, collection, segregation	BB & PPT	1	R4 & R8	CO3
28	E waste: Treatment and disposal	BB & PPT	2	R4 & R8	CO3
29	Biomedical wastes: Definition, sources, classification	BB & PPT	1	R6, R7 & R9	CO3
30	Biomedical wastes: Classification, collection, segregation	BB & PPT	1	R6, R7 & R9	CO3
31	Biomedical wastes: Treatment and disposal	BB & PPT	2	R6, R7 & R9	CO3
UNIT-IV: WASTE MANAGEMENT LEGISLATION					
32	Solid Waste (Management and Handling) Rules, 2000, 2016 and amendments	BB & PPT	2	W1, W2 & W4	CO4
33	Biomedical Waste (Management and Handling) Rules, 2016	BB & PPT	1	W1 & W2	CO4
34	Plastic Waste Management Rules, 2016	BB & PPT	2	W1 & W2	CO4
35	E-Waste Management Rules, 2016	BB & PPT	1	W2	CO4
36	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	BB & PPT	2	W2	CO4
37	Construction and Demolition Waste Management Rules, 2016	BB & PPT	1	W1	CO4
38	Schemes and programs of Government- Swachchh Bharat Abhiyaan	BB	2	W3	CO4
Total Hours/Lectures			50		

Prepared by: Dr. Renuka Gupta
Assoc. Prof. in EVS

SYLLABUS
SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Code: ESP-203-V/ EVS 302B **Theory: 75**
L T P **Sessional: 25**
4 0 0 **Total: 100**
Duration of Exam : 3 Hrs.

COURSE OUTCOMES:
At completion of the course, the learner will be able to:
CO1: Understand various concepts related to solid waste management.
CO2: Apply steps in solid waste management - waste reduction at source, collection techniques,
materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques.
CO3: Acquire the knowledge related to hazardous waste management.
CO4: Evaluate the solid waste management according to the legal framework.

UNIT-I: MUNICIPAL SOLID WASTE
Solid wastes: Sources, classification, characteristics of solid waste, Waste generation rates, Collection and storage of municipal solid wastes, transfer stations, waste processing - volume and size reduction, source reduction, recycling, waste minimization.

UNIT-II: WASTE TREATMENT AND DISPOSAL
Waste processing technologies, Incineration, Combustion, Stabilization, Solidification, chemical fixation, encapsulation, Composting, Vermicomposting, Energy from waste – Bio-gasification - Anaerobic digestion, pyrolysis, refuse derived fuels; Landfill bioreactors, Burning, open dumping- problems, Landfill – site selection, Sanitary and secured – structure, design, construction, operation and closure. Landfill leachate and gas management, Landfill bioreactors.

UNIT-III: HAZARDOUS WASTE MANAGEMENT
Hazardous waste: Definition, sources, classification, collection, segregation, characterization, Treatment and disposal.
Radioactive wastes: Definition, sources, classification, collection, segregation, Treatment and disposal.
E waste: Definition, sources, classification, collection, segregation, Treatment and disposal.
Biomedical wastes: Definition, sources, classification, collection, segregation, Treatment and disposal.

UNIT-IV: WASTE MANAGEMENT LEGISLATION
Solid Waste (Management and Handling) Rules, 2000, 2016 and amendments, Biomedical Waste (Management and Handling) Rules, 2016; Plastic Waste Management Rules, 2016; E-Waste Management Rules, 2016; Bio-Medical Waste Management Rules, 2016; Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016; Construction and Demolition Waste Management Rules, 2016. Schemes and programs of Government-Swachchh Bharat Abhiyaan.

REFERENCE BOOKS:
1. Solid Waste Management Manual CPCB, New Delhi.
2. *Ecotechnology for Pollution Control and Environmental Management* by Trivedy R.K. and Arvind Kumar.
3. Williams, Paul T. (2013) *Waste treatment and disposal,* John Wiley Publishers.
4. Johri, Rakesh (Ed.), (2009) *E-waste: Implications, regulations and management in India*

and Current global best practices, TERI press.
5. Letcher, Trevor M. (Ed.) (2011) *Waste: A handbook for management,* Academic Press London.
6. Sahai, Sushma (2009) *Bio- medical waste management*, APH Publishing.
7. Rosenfeld, Paul E., (2011) *Risks of hazardous wastes,* Elsevier London.
8. R E Hester (ed.); Roy M Harrison (ed.) (2008) *Electronic waste management: design, analysis and application,* Cambridge Royal Society of Chemistry.
9. Rao, M.N. and Sultana, R. (2012). Solid and Hazardous Waste Management, BS Publications, Hyderabad.

SUGGESTED WEB SOURCES:

1. https://cpcb.nic.in/rules-2/
2. https://vikaspedia.in/energy/environment/waste-management/solid-waste-managementrules
3. https://swachhbharat.mygov.in/
4. http://www.indiaenvironmentportal.org.in/content/about-us/