

**DISCIPLINE SPECIFIC ELECTIVES (DSE-EVS-2): SOLID WASTE MANAGEMENT**

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
DSE-EVS-2: SOLID WASTE MANAGEMENT	4	2	0	2	Class XII pass	NA

**Learning objectives**

The Learning Objectives of this course are as follows:

- Understand physical and chemical processes for classifying, segregating, and managing solid wastes
- Characterize the different solid waste types and apply interdisciplinary knowledge for effective solid waste collection and processing of solid waste
- Compare methods of collection, transfer, storage, treatment, disposal, and use of solid waste in developed and developing nations
- Management, construction, and operations of landfill and other solid waste management facilities

**Learning outcomes**

After successful completion of this course, students will be able to:

- Conduct the life cycle assessment of solid waste and its impact on the urban metabolisms
- Identify and select landfill sites using GIS and other analytical techniques
- Examine and apply technical and legal solutions for sustainable management of solid waste
- Plan and design waste recycling programmes, compost and incineration facilities, and landfills
- Mine and analyze the relevant data and apply multiple criteria decision-making systems for a sustainable integrated solid waste management plan

## SYLLABUS OF DSE-EVS-02

Theory (02 Credits: 30 lectures)

### **UNIT – I Effect of solid waste disposal on the environment (3 Weeks) (6 lectures)**

Sources and generation of solid waste, their classification and chemical composition; characterization of municipal solid waste; hazardous waste and biomedical waste. Impact of solid waste on environment, human and plant health; effect of solid waste and industrial effluent discharge on water quality and aquatic life; mining waste and land degradation; effects of landfill leachate on soil characteristics and groundwater pollution.

### **UNIT – II Common methods to manage solid waste (2 Weeks) (4 lectures)**

Different techniques used in the collection, storage, transportation and disposal of solid waste (municipal, hazardous and biomedical waste); landfill (traditional and sanitary landfill design); thermal treatment (pyrolysis and incineration) of waste material; drawbacks in waste management techniques.

### **UNIT – III Industrial waste management and resource recovery (4 Weeks) (8 lectures)**

Types of industrial waste: hazardous and non-hazardous; effect of industrial waste on air, water and soil; industrial waste management and its importance; stack emission control and emission monitoring; effluent treatment plant and sewage treatment plant. 4R- reduce, reuse, recycle and recover; biological processing - composting, anaerobic digestion, aerobic treatment; reductive dehalogenation; mechanical biological treatment; green techniques for waste treatment.

### **UNIT – IV Integrated waste management and waste-to-energy (4 Weeks) (8 lectures)**

Concept of Integrated waste management; waste management hierarchy; methods and importance of Integrated waste management. Concept of energy recovery from waste; refuse-derived fuel (RDF); different WTE processes: combustion, pyrolysis, landfill gas (LFG) recovery; anaerobic digestion; gasification. Life-cycle assessment (LCA): Cradle to grave approach; lifecycle inventory of solid waste; role of LCA in waste management; advantage and limitation of LCA; case study on LCA of a product.

### **UNIT – V Policies for solid waste management (2 Weeks) (4 lectures)**

Municipal Solid Wastes (Management and Handling) Rules 2000; Hazardous Wastes Management and Handling Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Ecofriendly or green products.

### **Teaching and learning interface for theoretical concepts**

To achieve the course objectives and match with the contents, a wide range of teaching and learning tools will be employed, including (a) Formal lectures; (b) Interactive sessions using visual aid; (c) Case study analyses; (d) Hypothetical scenario building; (e) Group discussion on key topics; and (f) documentary screening and critical analyses.

Practicals/Hands-on Exercises – based on theory (02 Credits: 60 hours)

1. Conduct life cycle assessment of solid waste generated in your institute/residential area/city
2. Design a composting pit for solid waste management in your institute or its nearby area
3. Conduct geotechnical characterization of the selected solid waste generated in the given area
4. Determine microbial density in the given solid waste collected from your institute
5. Estimate environmental impacts of greenhouse gases released and energy recovery from solid waste being collected in a given landfill
6. Assess cost-benefit analysis of various processing options of the given solid waste being managed in your city
7. Field survey of solid waste dumping site of your city, document the quantum of waste being collected and stored, and identify the hidden environmental issues
8. Analyze the site plan of the waste dumping site visited in 7, and compare and contrast it with the most successful design being used in the given developed country
9. Screen a documentary on solid waste management of national or international relevance. Identify and analyze socio-economic impacts and suggest scientific solutions to address the concerned environmental challenges.
10. Critically evaluate the recent plastic management policy of your country and make specific recommendations for immediate amendment aiming for environmental sustainability
11. Select a type of solid waste and prepare a documentary of its management in your city highlighting the merit/demerit of current practices, associated socio-economic and environmental issues and possible solutions suggested by experts
12. Compare and contrast solid waste management practices being adopted in two areas of your city with photographic and videographic evidence

#### Teaching and learning interface for practical skills

To impart training on technical and analytical skills related to the course objectives, a wide range of learning methods will be used, including (a) laboratory practicals; (b) field-work exercises; (c) customized exercises based on available data; (d) survey analyses; and (e) developing case studies; (f) demonstration and critical analyses; and (h) experiential learning individually and collectively.

#### Essential/recommended readings

- Bagchi, A. 2004. Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.
- Blackman Jr, W.C., 2016. Basic Hazardous Waste Management. CRC press.
- Chang, N.B. and Pires, A., 2015. Sustainable Solid Waste Management: A Systems Engineering Approach. John Wiley & Sons.

- Kaza, S., Yao, L., Bhada-Tata, P. and Van Woerden, F., 2018. What A Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. World Bank Publications.
- McDougall, F. R., White, P. R., Franke, M., & Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons.
- Rada, E.C. ed., 2016. Solid Waste Management: Policy and Planning for a Sustainable Society. CRC Press.

### **Suggestive readings**

- Asnani, P.U. and Zurbrugg, C., 2007. Improving Municipal Solid Waste Management in India: A Sourcebook for Policymakers and Practitioners. World Bank Publications.
- Christensen, T. ed., 2011. Solid Waste Technology and Management. John Wiley & Sons.
- Tchobanoglous, G. and Kreith, F., 2002. Handbook of Solid Waste Management. McGraw-Hill Education.
- Vanatta, B., 2000. Guide for Industrial Waste Management. Diane Publishing.

**Note:** Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.