| CEDX 44 | HAZARDOUS WASTE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| SDG: 6 & 12 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

The objectives of the course are

**COB1:** To impart knowledge on the various sources, characterization of hazardous wastes and various collection methods.

**COB2:** To familiarise the knowledge on the on-site and off-site processing techniques of hazardous waste including disposal methods.

**COB3:** To create the understanding on the reclamation and remediation techniques for the hazardous waste.

**COB4:** To impart knowledge on the types of electronic waste, methods of waste separation, reuse and recycle of E-waste.

**COB5:** To give an exposure to types, collection and separation of plastic waste and management of plastic waste.

**MODULE I HAZARDOUS WASTE AND COLLECTION METHODS 9**

Hazardous substances and wastes- Sources and quantity of generation – Composition and its physical form- Waste Collection, segregation at source, on and off site collection - Pre transport requirements - Safety in handling, transportation, storage, treatment and disposal technologies - Legal and Administrative requirements - Regulations for pollution control - Administrative liability.

**MODULE II TREATMENT METHODS 9**

Physical, chemical and biological treatment technologies – Criteria for treatment, storage and disposal facilities (TSDF) - Site selection for TSDF - Landfill, standards and guidelines for accepting a waste for land disposal- Leachate management - Thermal treatment - Incinerability tests, different types of incinerators and their applicability - Waste minimisation.

**MODULE III RECLAMATION AND REMEDIATION 8**

Reclamation of hazardous wastes - Management of gaseous emissions/air pollutants generated during treatment and disposal operations of hazardous wastes - Remediation of hazardous waste sites – Physical remediation – Bioremediation - Case studies.

**MODULE IV ELECTRONIC WASTE MANAGEMENT 9**

Introduction to electronic waste – Categories in electronic waste – Electronic waste management rules (2016) - Collection, separation of E-waste - Health hazard due

to informal recycling of E-Waste - Social impacts of recycling of E-Waste – E-waste Management - Life cycle assessment of E- waste

**MODULE V PLASTIC WASTE MANAGEMENT 10**

Introduction to plastics – Characteristics of plastics - Types of plastics - Plastic waste management rules (2016) - Size reduction of recycled plastics – cutting / shredding, densification, pulverization and chemical size reduction processes – Onsite recycling of plastics (household and industry) - Recycling of polymer thermoset composites – regrind processes – Pyrolysis and energy recovery - Recent Plastic Waste Management Practices.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Blackman, W.C “Basic Hazardous Waste Management”, CRC Press, New Delhi, 2016.
2. Habibur Rahman.M and Abdullah Al-Muyeed, “Solid and Hazardous Waste Management”, ITN – BUET, Bangladesh, 2010.
3. Plastic waste management in India: An integrated solid waste management approach, World Scientific Publishing Co., Singapore, 2014.
4. Stanley E. Manahan, “Industrial Ecology: Environmental Chemistry and Hazardous Waste”, Routledge, 2017.

**REFERENCES:**

1. Electronic Waste Management Rules 2016, Govt. of India. https://cpcb.nic.in/e-waste/
2. Michael D. Lagrega, Phillip L. Buckingham and Jeffrey C. Evans., “Hazardous Waste Management” 2nd Edition, McGraw Hill International, London, 2010.
3. MSW Management Rules 2016, Govt. of India https://cpcb.nic.in/rules-2/
4. Plastic waste Management Rules 2016, Govt. of India https://cpcb.nic.in/rules-4/.
5. Plastic waste management Issues, solution & case studies, Ministry of housing urban affairs, Government of India, 2019. (WWW.Mohua.gov.in.)
6. Rules and Regulation of Hazardous substance management”, Ministry of Environment, Forest and Climate change, 2015.

**COURSE OUTCOMES:**

At the end of the course the student will be able to

**CO1:** Identify the various sources, collection and treatment process of hazardous waste and will be able to explain about its legal provision.

**CO2:** Specify the basic requirements needed for land disposal and its management techniques.

**CO3:**Assess the various treatment methods of hazardous waste and summarise the various remediation techniques based on case studies

**CO4:** Enumerate about the classification of e-waste, health and social impacts due to e-waste and its management Rules.

**CO5:** Explain the characteristics of various types of plastics and regulate the plastic waste reuse, recycling and management process using plastic waste management Rules.

**Board of Studies (BoS) :**
18th BoS of CE held on 05.04.2023

**Academic Council:**
20th Academic council held on 13.4.2023

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | L | M | - | M | M | H | L | - | - | - | - | - | - | M |
| CO2 | L | L | M | - | M | M | H | L | - | - | - | - | - | - | M |
| CO3 | L | L | M | - | M | M | H | L | - | - | - | - | - | - | M |
| CO4 | L | L | M | - | M | M | H | L | - | - | - | - | - | - | M |
| CO5 | L | L | M | - | M | M | H | L | - | - | - | - | - | - | M |

**Note:** L- Low Correlation M - Medium Correlation H -High Correlation

SDG 6 : Ensure availability and sustainable management of water and sanitation for all.

SDG 12 : Ensure sustainable consumption and production patterns

The environmentally sound management of hazardous waste through treatment and remediation would substantially reduce its impact on the environment.