

| <b>ELECTRONIC WASTE MANAGEMENT</b>         |                           |
|--------------------------------------------|---------------------------|
| <b>Course Code: EEOE08</b>                 | <b>Credits: 3:0:0</b>     |
| <b>Pre – requisites: Nil</b>               | <b>Contact Hours: 42L</b> |
| <b>Course Coordinator: Dr. S. Poornima</b> |                           |

## **Course content**

### **Unit I**

**E - waste Perspective:** Introduction, types of contaminants in E waste- components and effects, Treatment strategies of E waste- Recycling, Landfill disposal, biological treatment, Indian and Global trends of E-waste- Asia, Africa, America (Chapter 1 of TB1, and Chapter 6 of TB2)

- Pedagogy / Course delivery tools: Chalk and talk
- Link: <https://www.youtube.com/watch?v=dI-DEBygfRg>
- <https://nptel.ac.in/courses/105105169>
- <https://www.youtube.com/watch?v=Y2ePj3wr8M>
- <https://nptel.ac.in/courses/105105169>

### **Unit II**

**Collection Systems:** Formal EWM – Government authorities, Extended Producer responsibility – goals, implementation and challenges, extended consumer responsibility, Take back policy, Informal EWM, 3R cycle – Reuse, Recycle and reduce, Imported e waste in India, Futuristic projection, Informal e-waste trade chain in India, opportunities and challenges in Indian EWM(Chapter 3 of RB2 and chapter 1 of RB3)

- Pedagogy / Course delivery tools: Chalk and talk
- Link <https://www.youtube.com/watch?v=oIpfOUzobas>
- <https://www.youtube.com/watch?v=BU7YzGPwdhA>
- <https://www.youtube.com/watch?v=p24qrWG4QDU>

### **Unit III**

**Recycling Process Modeling:** Physical techniques – Dismantling, crushing, shredding and milling, sieving and separation, Chemical techniques – pyro metallurgy, hydrometallurgy- Acid/alkaline, cyanide, thiourea, thiosulfate, Bio metallurgy - Bioleaching, Bio sorption, extraction of gold and silver nanoparticles from E-waste, challenges in recovery process, future research aspects (chapter 2 of TB1)

- Pedagogy / Course delivery tools: Chalk and talk

- Link: <https://www.youtube.com/watch?v=Xbl1SWRypgc>

#### Unit IV

**Recycling of Electrical and Electronics components:** Recycling of PCBS- Disassembling, physical – mechanical recycling, size reduction and separation, Dismantling, recovery of copper, Recycling of LCDS- composition and characterization, Barriers, manual and automated disassembly, recovery of valuable components, reuse of LCD components, recycling of cooling and freezing appliances – challenges, degassing process requirements, volatile organic compound emission, removal of plastics, Recycling of Batteries – main, pyro metallurgical and hydrometallurgical routes, (chapter 11,12,13,14 of TB2)

- Pedagogy / Course delivery tools: Chalk and talk
- Link: <https://www.youtube.com/watch?v=oIpfOUzobas>

#### Unit V

**Impacts on environment and Human health:** Composition, fate, toxic compounds in E-waste, Impacts of E-waste on soil aquatic ecosystems, atmosphere, Environmental impacts of a cell phone, computer, CRT monitor, Impacts and associated risks on public health, safety measures for final disposal. (chapter 5 of TB1, RB 2)

- Pedagogy / Course delivery tools: Chalk and talk
- Link: <https://nptel.ac.in/courses/105105169>
- <https://www.youtube.com/watch?v=BzsEjXZcuIY>
- <https://www.youtube.com/watch?v=HV2Ir1e513o>

#### Textbooks:

1. Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, *Handbook of Electronic Waste Management: International Best Practices and Case Studies*, Elsevier 2020.
2. Vannessa Goodship, Ab Stevels, Jaco Huisman, *Waste Electrical and Electronic Equipment (WEEE) Handbook*, Elsevier, 2<sup>nd</sup> Edition, 2019.

#### Reference books:

1. Sunil Kumar, Vineet Kumar, *Electronic Waste Management: Policies, Processes, Technologies, and Impact*, Wiley Publishers, 2024.
2. *Management of Electronic Waste: Resource Recovery, Technology and Regulation*, Anshu Priya, Wiley, 2023.

3. Varsha Bhagat Ganguly, *E-WASTE MANAGEMENT Challenges and Opportunities in India*, Taylor and Francis, 2022

### Course Outcomes (COs):

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

1. Understand the sources, composition, classification, and environmental concerns associated with electronic waste. (PO1,2,6,11 & PSO 1,3)
2. Analyse the various e-waste collection systems and government policies for sustainable e-waste management. (PO1,2,6,11& PSO 1,3)
3. Describe various physical, chemical, and biological recycling techniques used for material recovery from electronic waste. (PO1,2 & PSO 1)
4. Evaluate recycling processes for electrical and electronic equipment. (PO1, 2 & PSO 1)
5. Assess the environmental and human health impacts of e-waste. (PO1,2,6,11& PSO 1,3)

### Course Assessment and Evaluation:

| <b>Continuous Internal Evaluation (CIE): 50 Marks</b>              |              |                                 |
|--------------------------------------------------------------------|--------------|---------------------------------|
| <b>Assessment tool</b>                                             | <b>Marks</b> | <b>Course outcomes attained</b> |
| Internal Test-I                                                    | 30           | CO1, CO2                        |
| Internal Test-II                                                   | 30           | CO3, CO4, CO5                   |
| <b>Average of the two internal test will be taken for 30 marks</b> |              |                                 |
| <b>Other components</b>                                            |              |                                 |
| Assignment/ Simulation                                             | 10           | CO1, CO2, CO3, CO4, CO5         |
| Term Paper/ Presentation                                           | 10           | CO1, CO2, CO3, CO4, CO5         |
| <b>Semester End Examination (SEE)</b>                              | 100          | CO1, CO2, CO3, CO4, CO5         |