

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI**  
**B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering**  
**NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)**  
**(Effective from the academic year 2021 – 22)**

**VII Semester**

E-waste Management			
Course Code	21EC755	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
<b>Course objectives:</b> <ul style="list-style-type: none"><li>• <b>Current Status:</b> According to a report on e-waste presented by the United Nations (UN) in World Economic Forum on January 24, 2019, the waste stream reached 48.5 MT in 2018. With such a large quantity of e-waste being generated each year, the future of e-waste recycling in India looks pretty bright. The E-waste (Management) Rules, 2016, enacted on October 1, 2017, added over 21 products (Schedule-I) under the purview of the rule.</li><li>• <b>Purview:</b> This course covers an extensive review of e-waste management in India. With a focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste. It also includes a survey of pan-India initiatives and trajectories of law-driven initiatives for effective e-waste management along with responses from industries and producers.</li><li>• <b>Scope:</b> There is a considerable scope for e-waste recycling in India. It is not only a solution to help mitigate e-waste management issues, but it also helps to generate employment. With the rise in e-waste recycling plants, the demand for employees with all levels of qualification and skills also increases.</li></ul>			
<b>Teaching-Learning Process (General Instructions)</b> <p>These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"><li>1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.</li><li>2. Show Video/animation films to explain the functioning of various techniques.</li><li>3. Encourage collaborative (Group) Learning in the class</li><li>4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking</li><li>5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.</li><li>6. Topics will be introduced in multiple representations.</li><li>7. Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.</li><li>8. Arrange visits to nearby industries to give industry exposure.</li></ol>			
<b>Module-1</b>			
<b>Sustainable development and e-waste management:</b> Importance of electrical and electronic equipment in a nation's development, and e-waste as toxic companion of digital era, I: Let's understand e-waste, II: E-waste statistics: quantities, collection and recycling, E-waste categories and harmonising statistics, III: An overview on status of e-waste related legislation across the globe; IV: UN initiatives for e-waste management: creating partnerships and achieving Agenda 2030; V: Indian scenario: e-waste generation, collection and recycling.			
<b>Teaching-Learning Process</b>	Chalk and talk method, YouTube videos. <b>RBT Level:</b> L1, L2		
<b>Module-2</b>			
<b>Extended producer responsibility: a mainstay for e-waste management:</b> Evolution of concept of 'extended producer responsibility'. EPR applied for waste management and extended for e-waste			

<p>management, EPR: goals, implementation, and challenges for e-waste management, EPR implemented for e-waste management under the existing regulatory frameworks in different countries, Role of a PRO prescribed in regulatory framework, Considerations for successful implementation of EPR, Challenges in implementation of EPR for e-waste management, Impact of EPR, EPR and e-waste management in India.</p> <p><b>Toxicity and impacts on environment and human health:</b> Toxicity, recycling, and regulations, I: Environmental concerns, II: Human health concerns.</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, PowerPoint Presentation, More examples relating to applications. <b>RBT Level:</b> L1, L2, L3
<b>Module-3</b>	
<p><b>Treating e-waste, resource efficiency, and circular economy:</b> Safe environment, resource use, and circular economy, Circular economy: recycling, resource recovery, and resource efficiency, Potentials of urban mining in circular economy, Recycling and resource efficiency related challenges to the circular economy, Urban mining, recycling, resource use, resource efficiency, and circular economy in India.</p> <p><b>E-waste management through legislations in India:</b> I: Historical backdrop of regulatory regime for e-waste in India, II: E-waste (management) Rules, 2016 and E-waste (management) Amendment Rules, 2018, III: Analysing performance of EPR and CPCB as regulatory mechanisms, IV: Legal cases and judicial directives.</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, PowerPoint Presentation <b>RBT Level:</b> L1, L2, L3
<b>Module-4</b>	
<p><b>Strategies and initiatives for dealing with e-waste in India:</b> I: Overview of pan-India initiatives for dealing with e-waste during 2000 and 2012, II: Law-driven e-waste management – initiatives by the government, non-government agencies, and judiciary.</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, PowerPoint Presentation. <b>RBT Level:</b> L1, L2, L3
<b>Module-5</b>	
<p><b>Moving towards horizons:</b> I: Legal and judicial domain, II: Economic concerns, III: Environment concerns, IV: Recycling culture/recycling society.</p>	
<b>Teaching-Learning Process</b>	Chalk and talk method, PowerPoint Presentation, More examples relating to applications. <b>RBT Level:</b> L1, L2, L3
<p><b>Course outcome (Course Skill Set)</b></p> <p>At the end of the course the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the existing discourse on e-waste and its management, statistics across the world, opportunities, and challenges w.r.t. regulatory framework, SDGs, CE, and LCIA (Life Cycle Impact Assessment) and MFA (Material Flow Analysis), Indian scenario.</li> <li>2. Describe EPR, a regulatory framework for achieving specified goals across different countries and impacts on environment and human health.</li> <li>3. Explain themes in the context of resource use and sustainable development. Urban mining, informal sector operations and need for resource use policy, financial support for recycling infrastructure building, etc. in Indian context and also explain to what extent – different aspects of e-waste management have been incorporated in the existing regulatory framework in comparison with international legislatures.</li> <li>4. Identify and infer pan-Indian initiatives dealing with e-waste management, ranging from building knowledge base through research and social action by different stakeholders to technological and legal advancements, and industrial initiatives. Analyse roadmap for the Agenda 2030.</li> <li>5. Use opportunities and challenges around four domains: legal and judicial domain; economic concerns; recycling culture/society; and environment concerns.</li> </ol>	

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5<sup>th</sup> week of the semester
2. Second test at the end of the 10<sup>th</sup> week of the semester
3. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

**Suggested Learning Resources:****Text Book:**

Varsha Bhagat Gangulay, 'E-Waste Management', Taylor and Francis, 2022.

**Web links and Video Lectures (e-Resources)**

- <https://link.springer.com/book/10.1007/978-3-030-14184-4>
- [https://rajyasabha.nic.in/rsnew/publication\\_electronic/E-Waste\\_in\\_india.pdf](https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf)
- <https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-Manual.pdf>
- <https://nptel.ac.in/courses/105105169>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Groups can be made to conduct a survey on the present scenario of India and top 5 countries facing ewaste management challenges.
- Industry visits to give an exposure of the e waste management process and also business.
- Case studies to develop e-waste management models.
- Survey of few e-waste management companies can be carried out and submit report.