World Skill Development Institute

Electronic Waste Recycling

(Printed Circuit Board, LCD, Cell Phone, Battery, Computers)

Course Duration – 6 months.

Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also considered as e-waste. With advancements in the electronic world almost occurring on a day-to-day basis and increased availability of products to the public, it is not surprising to see a staggering increase in the generation of electronic wastes over the past decade. The e-waste now represents the biggest and fastest growing manufacturing of wastes with as high as about 40 million tons a year at the global level. All these thing leads to increase in E-waste generation in the country.

Electrical and electronic equipment contain different hazardous materials which are harmful to human health and the environment, if not disposed of carefully. Due to the lack of awareness for e-waste recycling in emerging economies, innovation hubs and centres of excellence have not yet been established. This has leads to the requirement of a proper disposal and recycling system so that environmental pollution and health hazard is reduced. We have tried to give information in this course which will help in minimizing this ever growing problem.

Today the electronic waste recycling business is in all areas of the developed world a large and rapidly consolidating business. This recycling is done by sorting, dismantling, and recovery of valuable materials. This diversion is achieved through reuse and refurbishing.

This course aims at providing a thorough understanding and analysis of the E-Waste in the wake of evolving market dynamics. The course describes E-waste rules by Ministry of Environment and Forests. The course discusses the overview of the E-Waste Recycling along with their Classification, Composition, Recycling Process of different products and effects of E-waste on environment and human health. Also the course contains suppliers contact details of plant & machinery.

The course covers E-waste Recycling- An Introduction, Overview of WEEE/E-Waste Management, Hazardous Materials in E-Waste, E-Waste Management System Specifications, Recycling of E-Waste, Recycling of Printed Circuit Board, Recycling of Liquid Crystal Display, Cell Phones Recycling, Battery

Recycling, Computer Recycling, Restriction of Hazardous Substances Directive and Environmental Aspects.

It is a standard course for Professionals, Decision-makers, Engineers, those Studying and Researching in this important area and others interested in the field of E-Waste Recycling. Professionals in academia and industry will appreciate this comprehensive and practical course, due to its multidisciplinary nature.

1.E-WASTE RECYCLING–AN INTRODUCTION

Composition of E-Waste

Components of E-Waste

Status of E-Waste in India

SWOT Analysis

SWOT Analysis of E-Waste Management

E-Waste Legislation in India

The Hazardous Waste (Management and Handling) Rules, 2003

The Hazardous Waste (Management, Handling and Trails boundary Movement) Rules, 2008

Guideline for Environmentally Sound Management of E-Waste, 2008

The E-Waste (Management and Handling) Rules, 2011

Loopholes in Legislations

Integrated Product Policy

Sustainable Development

2.OVERVIEW OF WEEE/E-WASTE MANAGEMENT

Introduction

Mechanism of WEEE/E-waste Trade

WEEE/E-waste Life Cycle

WEEE/E-Waste Material Flow Model

Phase I

Phase II

Phase III

Phase IV

Components of WEEE/E-waste Management

Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union

Obligations of the Producer under the WEEE

Barriers to Recycling of WEEE

WEEE Health and Safety Implications

3.HAZARDOUS MATERIALS IN E-WASTE

Valuable Materials in E-Waste

Possible Hazardous Substances Present in E-Easte

Component Possible Hazardous Content

Glycol, Other Unknown Substances

Plastics Containing Brominated Flame Retardants (BFRs)

Insulation

Asbestos

Refractory Ceramic Fibers (RCFs)

Liquid Crystal Display (LCDs)

Components Containing Plasticisers/Stabilizers

Circuit Boards

Flame Retardants

Lead

Mercury

Beryllium

Capacitors

Electrolyte Capacitors

Capacitors Containing Poly Chlorinated Biphenyls (PCBs)

4.E-WASTE MANAGEMENT SYSTEM SPECIFICATIONS

Tentative Specifications for E-Waste Collection System

Tentative Specifications for E-waste Treatment System

Manual E-Waste Dismantling/Treatment Plant

Semi-Automatic E-Waste Dismantling/Treatment Plant

Automatic E-Waste Dismantling/Treatment Plant

Common Specifications for Utilities at Collection Centers and Processing Facilities

5.RECYCLING OF E-WASTE

Individual Processes

Crushing/Diminution

Size Classification

Magnetic Separation

Density Separation

Eddy Current Separation

Electrostatic Separation

Outputs and Markets

Metals

Glass

Plastics

Emerging Recycling and Recovery Technologies

Automated Disassembly

Comminution

Separation

Thermal Treatments

Hydrometallurgical Extraction

Dry Capture Technologies

Biotechnological Capture

Sensing Technologies

Design for Recycling and Inverse Manufacturing

E-Waste Segregation and Disposal Method

Structure and Main Steps in the Recycling Chain

Structuring of the Recycling Chain

6.RECYCLING OF PRINTED CIRCUIT BOARD

Composition of Printed Circuit Board

Characteristics of PCB Scrap

Density Differences

Magnetic and Electrical Conductivity Differences

Polyformity

Liberation Size

Chemical Reactivity

Electropositivity

Materials

Fabrication Process for Printed Circuit Process (PCB)

Mechanical Recycling Process of Printed Circuit Boards (PCBs)

PCB Recycling of the Metal Fraction

Pyrometallurgy

Hydrometallurgy

Biometallurgy

Challenges and Future Trends

Dismantling

Recovery of Copper and Precious Metals

Recycling and Recovery of the Non-Metallic Materials

7.RECYCLING OF LIQUID CRYSTAL DISPLAY

Composition and Characterisation of LCDs

Barriers to Recycling of LCDs

Recycling Processes for Liquid Crystal Displays (LCDs)

Manual Disassembly

Manual Disassembly Processing for LCDs

Automated Processes for LCD Recycling

Automated Disassembly Processes for LCDs

Hazardous Materials in Liquid Crystal Displays (LCDs)

Environmental Concerns of LCD

Loss of Light Energy

Hazardous Chemical

Hazardous Gases

Mercury Accumulation in End-of-Life Products

8.CELL PHONES RECYCLING

A Cell Phone Contains Just a Few Individual Parts

Harmful Substances in Mobile Phones

Cadmium

Lead

Lithium

Mercury

Process Overview

Collection and Transportation

Pre-Processing

Reuse of Phones

Reuse of Components

Recycling of Materials

I. Pre-treatment

II. Copper Recovery

III. Precious Metals Recovery

IV. Recovery Rate

9.BATTERY RECYCLING

Main Processing Routes

Pyrometallurgical Route

Hydrometallurgical Route

Metallurgical Aspects of Lead Recycling from Battery Scrap

Technical Steps in Battery Recycling

Dismantling of Battery Cases and Feed Preparation

Melting and Reduction Operation of Paste and Battery Fines

Melting of Grids, Terminals and Bridges

Refining of Crude Lead

Gas Cleaning System

10.COMPUTER RECYCLING

Composition of Computer

Recycling Process of Computers

Collection

Sorting, Processing and Reuse in Production

Removing the Large Objects

Test for Potential Reuse

Manual Disassembly

Separation into Material Composition

Disposal of Non-Recyclable Parts

Purchase of Products Made of Recycled Materials

11.RESTRICTION OF HAZARDOUS SUBSTANCES DIRECTIVE

RoHS Compliance

The RoHS Directive and Proscribed Materials

RoHS Proscribed Materials

Lead

Brominated Flame Retardants

Cadmium, Mercury and Hexavalent Chromium

Benefits ROHS

Health Benefits

Reliability Concerns Unfounded

Flow Properties and Assembly

Some Exempt Products Achieve Compliances

12.E-WASTE RULES BY MINISTRY OF ENVIRONMENT AND FORESTS

Modified Draft Notification

General

Responsibilities

Procedure for Seeking Authorization and Registration for Handling E-wastes

Procedure for Registration with State Pollution Control Board

Reduction in the Use of Hazardous Substances (ROHS) in the Manufacture of Electrical and Electronic Equipment

Miscellaneous

Schedule-I

Schedule-II

Schedule-III

13.ENVIRONMENTAL ASPECTS

Effects on Environment and Human Health

Pollutants in E-Waste

Impact of Hazardous Substances on Health and Environment

Dealing with E-Waste

Management Options to Severity of the Problem

Responsibilities of the Government

Responsibility and Role of Industries

Responsibilities of the Citizen

Need for Stringent Health Safeguards and Environmental Protection Laws in India

14.ADDRESSES OF PLANT AND MACHINERY SUPPLIERS