

5. MATERIAL RECYCLING & WASTE MANAGEMENT

Module I

Introduction to waste (8 Hours)

Sources and different types of wastes. The aim of waste management. Principles of waste management: Waste hierarchy, Life-cycle of a product, Resource efficiency.

Waste handling: Waste handling practices, Waste segregation methods.

Disposal methods: Recycling, Re-use; Biological reprocessing, Energy recovery (waste to energy), Pyrolysis, Resource recovery.

Adverse effects of solid wastes.

Module II

Plastic waste and management (10 Hours)

Plastics waste composition – Plastics waste, disposal alternatives, Need for recycling, Sorting and segregation of waste, Plastics identification & separation technique (Density-Float sink & Froth floatation methods), Recycling codes, Plastic waste management, 4R's approach (Reduce-Reuse-Recycle-Recover), Recycling Classification-Primary, Secondary, Tertiary, Quaternary recycling with examples

Module III

Primary & Secondary recycling techniques (8 Hours)

Primary recycling – Equipments for primary recycling. Specific recycling techniques – Recycling olefins, PVC, polyester, PE films, PP battery case – Crushing and separation – post consumer PET bottles. Recycling of plastics from urban waste – rheology, density, mechanical behavior.

Secondary recycling- (mechanical recycling), Plastics wastes containing paper – hydrolytic treatment – processing methods – processing of mixed plastics waste – household waste – industrial sector.

Module IV

Tertiary & Quaternary recycling techniques (6 Hours)

Tertiary/Feedstock recycling – Reactors used – Advantages– Dry method wet method Quaternary recycling (energy recovery) from waste plastics- Pyrolysis, Incineration-advantage and disadvantages, factors affecting incineration.

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

Module V

Application of waste plastics in commercial products (8 Hours)

Application of recycled materials, use of recyclable plastics in motor vehicles – recoverable materials – disposal of residuals – recyclable plastic components – virgin and recycled HDPE – Fluorinated and non-fluorinated HDPE – fuel tanks.

Text and Reference Books:

- [1] Marcel Dekker, "Plastic Waste Management", New York, 1995.
- [2] Edited by Nabil Mustafa, Plastic waste management, 1st edition.
- [3] Francesco La Mantia., " Handbook of plastics recycling" Chem Tech Publishing, 2002
- [4] Muna bitter, Johannes Brandup, George Menges "Recycling and recovery of plastics" 1996
- [5] Nabil Mustafa –"Plastics waste management" Marcel Dekker Inc., 1998
- [6] John Scheirs., - "Polymer Recycling" John Wiley and Sons., 1998.

LAB

1. COMPOSITE MANUFACTURING TECHNIQUE LAB

2. NANOSCIENCE AND TECHNOLOGY LAB