

1154CE101 (VTUR15)	RESOURCE AND ENERGY RECOVERY FROM WASTE	L	T	P	C
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COURSE CATEGORY: Institute Elective

A. PREAMBLE :

To understand the principles and design of recovering materials and energy from wastes through mechanical, biological and thermal methods and learn to manage the undesirable by-products.

B. PRE-REQUISITES:

- NIL

C. COURSE EDUCATIONAL OBJECTIVES:

Students undergoing this course are expected to:

- Understand the different methodologies to recover certain resources and energy from waste.
- Differentiate the mechanical, biological and thermos-chemical methods of energy recovery from waste.
- Outline the waste management hierarchy and recycling possibilities for a given waste stream.

D. COURSE OUTCOMES:

Upon the successful completion of the course, learners will be able to

CO	STATEMENT	K LEVEL
CO1	Explain the mechanical methods for material recycling.	K2
CO2	Illustrate the biological processes for resource recovery from waste streams.	K2
CO3	Compare the bio-chemical conversion processes for waste to energy.	K2
CO4	Outline the thermos-chemical conversion processes for waste to energy.	K2
CO5	Summarize the best possible waste recycling methods for a given waste stream.	K2

E. CORRELATION OF COS WITH POS:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						L						
CO2					M							
CO3					M	M						
CO4					M	M						
CO5					M			L	M			M

F. COURSE CONTENT:

UNIT I MECHANICAL PROCESSING FOR MATERIAL RECYCLING 9

Resource recovery for a sustainable development- Material and energy flow management and analysis - Systems and processes for reduction, reuse and recycling - Objectives of waste processing- Source segregation and hand sorting- Waste storage and conveyance – Shredding – Pulping - Size separation by screens.

UNIT II BIOLOGICAL PROCESSING FOR RESOURCE RECOVERY 9

Mechanisms of biological processing – Aerobic processing of organic fraction - Composting methods and processes - Factors affecting - Design of windrow composting systems – In-vessel composting - Compost quality control- Vermiculture: definition, scope and importance - Environmental requirements - Culture methods- Applications of vermiculture.

UNIT III BIO-CHEMICAL CONVERSION OF WASTE TO ENERGY 9

Principles and Design of Anaerobic Digesters – Process characterization and control- The biochemistry and microbiology of anaerobic treatment - Toxic substances in anaerobic treatment - Methane generation by Anaerobic Digestion- Single stage and multistage digesters- Digester design and performance-Gas collection systems.

UNIT IV THERMO-CHEMICAL CONVERSION OF WASTE TO ENERGY 9

Principles and Design of Energy Recovery Facilities -Types and principles of energy conversion processes - Incinerator design - Mass Burn and RDF Systems- Composition and calorific value of fuels and waste, Determination of the stoichiometric air consumption, Calculation of the flue gas composition - Grate firing designs, boiler design, removal of bottom ash, heat recovery - Emission Controls – Flue gas cleaning, de-dusting, flue gas scrubbers, DeNOx processes, dioxins and furans – Pyrolysis process-Alternative processes.

Recycling technologies for paper, glass, metal, plastic – Used lead acid battery recycling - Electronic waste recycling – Waste oil recycling – Solvent recovery -Environmental impacts of waste recycling-DFE.

TOTAL: 45 PERIODS

G. LEARNING RESOURCES:**a) REFERENCES:**

1. Arne Veslind and Alan E Rimer (1981), Unit operations in Resource Recovery Engineering, Prentice Hall Inc., London
2. Manser A G R, Keeling A A (1996). Practical handbook of processing and recycling on municipal waste. Pub CRC Lewis London, ISBN 1-56670-164
3. Chiumenti, Chiumenti, Diaz, Savage, Eggerth, and Goldstein, Modern Composting Technologies , JG Press October 2005
4. Charles R Rhyner (1995), Waste Management and Resource Recovery, Lewis Publishers
5. Gary C. Young (2010) Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, John Wiley & Sons.

b) ONLINE RESOURCES:

1. https://onlinecourses-archive.nptel.ac.in/noc19_ch13/course