WASTE AS A SOURCE OF ENERGY

(Open Elective)

II Semester

Subject Code:19CH21P1	L	P	C
	2	0	2

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

CO1: Differentiate and characterize different waste

CO2: Recognize the various waste to energy conversion processes

CO3: Explain the various biochemical conversion processes.

CO4: Explain the various thermochemical conversion processes.

CO5: Explain the various biomass process to energy conversion.

UNIT-I **(6 Lectures)**

Characterization and classification of waste as fuel: agro based, forest residues, industrial waste, domestic waste, Municipal solid waste.

Learning Outcomes:

1. Characterization of waste as fuel (L2)
2. Classify waste from different sources (L4)
3. Describe the characteristics of industrial waste (L2)

UNIT-II **(7 Lectures)**

Waste to energy options: combustion (unprocessed and processed fuel), gasification, anaerobic digestion, fermentation, pyrolysis.

Learning Outcomes:

1. Describe the process of converting waste to energy using combustion(L2)
2. Illustrate anaerobic digestion (L3)
3. Explain Gasification. (L2)

UNIT-III **(7 Lectures)**

Energy from waste- Bio-chemical Conversion: Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion, biogas production, land fill gas generation and utilization.

Learning Outcomes:

1. Describe the process of converting waste to energy using Anaerobic digestion of sewage and municipal waste(L2).
2. Explain the process of bio-gas production from waste. (L2)
3. Describe direct combustion of Municipal Solid Waste(L2)

UNIT-IV **(6 Lectures)**

Energy from waste-thermo chemical conversion: Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting, environmental and health impacts of incineration; strategies for reducing environmental impacts.

Learning Outcomes:

1. Describe different thermo-chemical conversion of waste to energy (L2)
2. Summarize the environmental and health impacts of incineration (L2)
3. Outline the strategies for reducing environmental impacts thermos-chemical conversion (L3)

UNIT-V **(6 Lectures)**

Biomass energy technologies: Biomass characterization (proximate and ultimate analysis); Biomass pyrolysis and gasification; Biofuels – biodiesel, bioethanol, Biobutanol; Algae and biofuels; Hydrolysis & hydrogenation; Solvent extraction of hydrocarbons; Pellets and bricks of biomass; Biomass based thermal power plants; Biomass as boiler fuel.

Learning Outcomes:

1. Describe different biomass technologies(L2).
2. Explain Biomass characterization(L2)
3. Describe the working of Biomass based thermal power plants (L2)

TEXT BOOKS:

1. Desai Ashok V., *Non Conventional Energy*, Wiley Eastern Ltd., 1980.

2. Pichtel John, *Waste Management Practices Municipal, Hazardous and Industrial* , Taylor & Francis , 2005.