WASTE TO ENERGY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB30	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students will gain insights into the principles associated with effective energy management using biomass resources. They will understand the different conversion technologies and their applications in sustainable energy systems. By applying these principles in their daily lives, students will be able to make informed decisions regarding energy consumption, resource utilization, and environmental sustainability.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The principles associated with effective energy management and to apply these principles in the day to day life.
II. The collection, transfer and transport of municipal solid waste.
III. The design and operation of a municipal solid wasteland fill.
IV. The key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Identify** the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Remember
CO 2	**Explain** the energy generation technologies from waste treatment plants and disposal of solid waste by aerobic composting and incineration process.	Understand
CO 3	**Illustrate** the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Analyze
CO 4	**Understand** the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 5	**Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Create

IV. SYLLABUS:

UNIT-I	**INTRODUCTION TO ENERGY FROM WASTE**	**Classes: 09**

Introduction to Energy from Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste. MSW, Conversion devices. Incinerators, gasifiers, digestors

UNIT-II	**BIOMASS PYROLYSIS**	**Classes: 09**

Biomass Pyrolysis: Pyrolysis, Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III	**BIOMASS GASIFICATION**	**Classes: 09**

Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation. Gasifier burner arrangement for thermal heating.

Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV	BIOMASS COMBUSTION	Classes: 09
Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.		
UNIT-V	**BIOGAS**	**Classes: 09**
Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system. Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion. Types of biogas Plants, Applications. Alcohol production from biomass, Bio diesel production. Urban waste to energy conversion, Biomass energy programme in India.		
Text Books:		
1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd., 1990.		
Reference Books:		
1. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book", Vol. I & II Tata McGraw Hill Publishing Co. Ltd., 1983. 2. Challal, D. S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.		
Web References:		
1. http://nptel.ac.in/courses/103107125/		
E-Text Books:		
1. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996..		