

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			
<p style="color: blue;">COURSE OBJECTIVES:</p> <p>The course should enable the students to:</p> <ol style="list-style-type: none"> I. Understand the principles associated with effective energy management and to apply these principles in the day to day life. II. Develop insight into the collection, transfer and transport of municipal solid waste. III. Explain the design and operation of a municipal solid wasteland fill. IV. Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities. <p style="color: blue;">COURSE OUTCOMES (COs):</p> <ol style="list-style-type: none"> I. Describe basic concepts of waste to energy resources and their conversion devices. II. Understand the concept of pyrolysis and the production of different products by using pyrolysis. III. Explore different types of biomass gasification techniques and understand Biochemical conversion of biomass for energy application. IV. Explore different types of biomass combustion techniques and their working operations. V. Describe the basic concepts of biogas and explore Biogas plant technology and their applications. <p style="color: blue;">COURSE LEARNING OUTCOMES (CLOs):</p> <ol style="list-style-type: none"> 1. Explain about different types of waste to energy resources. 2. Understand basic concept of energy conversion and explore different types of conversion devices. 3. Understand basic concept of pyrolysis and their types. 4. Describe the concept of Manufacture of charcoal, and their Methods. 5. Describe the concept of Manufacture of pyrolytic oils and gases and their applications. 6. Describe the concept of biomass gasification technique and their gasification types and techniques. 7. Explain about the Gasifier engine arrangement for the production of electrical power and their considerations. 8. Understand about the concept of biomass combustion through some exotic designs . 9. Explore on various combustion techniques and their operations. 10. Understand about the basic concepts of biogas. 11. Demonstrate about Biogas plant technology and Bio energy system. 12. Explain about the concept of Alcohol production from biomass and Bio diesel production. 13. Discuss about the Biomass energy program in India. 								
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
<p>Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation. Gasifier burner arrangement for thermal heating.</p> <p>Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.</p>		
UNIT-IV	BIOMASS COMBUSTION	Classes: 09
<p>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.</p>		
UNIT-V	BIOGAS	Classes: 09
<p>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.</p>		
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..		