SCHEME OF COURSE WORK

Course Title	Waste as a Source of Energy		
Course Code	19CH21P1	L T P C	: 2 0 0 2
Program:	M.Tech.		
Specialization:	Open elective		
Semester	II		

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

1	Differentiate and characterize different waste
2	Recognize the various waste to energy conversion processes.
3	Explain the various biochemical conversion processes
4	Explain the various thermochemical conversion processes.
5	Explain the various biomass process to energy conversion.

Program Outcomes (POs)
At the end of the program, the students will be able to

PO Code	Program Outcome (PO)
PO1	exhibit in-depth knowledge in thermal engineering specialization
PO2	think critically and analyse complex engineering problems to make creative advances in theory and practice
PO3	solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment
PO4	use research methodologies, techniques and tools, and will contribute to the development of technological knowledge
PO5	apply appropriate techniques, modern engineering tools to perform modelling of complex engineering problems with knowing the limitations
PO6	understand group dynamics, contribute to collaborative multidisciplinary scientific research
PO7	demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors
PO8	communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
PO9	engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously
PO10	exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community
PO11	examine critically the outcomes of actions and make corrective measures

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO-1		S		S						
CO-2	S		S		S	M	M		M	
CO-3	S		S		S	M	M	S		
CO-4	S		S		S	M	M	S		
CO-5	M	S	M	M	S	M	S	S	S	S

S - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation S* - Strongly correlated, *M - Moderately* correlated, *Blank - No correlation*

Teaching-Learning and Evaluation

Week	Topic / Contents	Course Out Comes	Sample Questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	Introduction to Waste to energy production	CO1	1. How are agro based wastes characterized? 2. Explain in detail the characteristics of forest based wastes 3. What are the predominant characteristics of domestic wastes that are suitable for energy production	Lectures PPT, Seminar	Seminar, Assignments (week 3-8)
1	Characterization of waste as fuel	CO1			
2	Classification waste from different sources	CO1			
3.	Classification waste from different sources	CO1			
4	characteristics of industrial waste	CO1			
5	converting waste to energy using combustion	CO2	1. Explain in detail the process of gasification 2. Explain the process of anaerobic digestion	Lectures PPT, Seminar	
6	Fundamentals of Gasification	CO2			
7	Fundamentals of Gasification	CO2			
8	Mid-Test 1	CO-1, CO-2			
10	Conversion of waste to energy using combustion	CO3	1. Describe the process of production of energy from Municipal solid wastes 2. Describe the working of a recirculating fluidized bed gasifier	Lectures PPT, Seminar	Seminar, Assignments (week 11-16)
11	bio-gas production from waste	CO3			
12	combustion of Municipal Solid Waste	CO3			
12	different types of thermo-chemical conversion of waste to energy	CO4	1. What are the advantages of briquetting? How are briquettes manufactured? 2. Explain the various strategies for reducing the environmental impacts of incineration	Lectures PPT, Seminar	
13	environmental and health impacts of incineration	CO4			
14	strategies for reducing environmental impacts thermos-chemical conversion	CO4			
15	different biomass technologies	CO5	1. Explain the working of a biodiesel extraction plant with a neat sketch 2. How is oil extracted from algae? Describe this process with a neat sketch	Lectures PPT, Seminar	
16	Biomass characterization	CO5			
17	working of Biomass based thermal power plants	CO5			
18	Mid-Test 2	CO-3, CO-4, CO-5			
19/20	END EXAM	All Cos			