

22REE302 BIO-ENERGY SYSTEMS: DESIGN AND APPLICATIONS

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Fundamentals of biomass production, biomass preparation techniques.

COURSE DESCRIPTION AND OBJECTIVES:

The objective of this course is to provide the knowledge and apply the same for bio-energy production and its industrial application.

MODULE-1

UNIT-1

8L+0T+8P=16 Hours

FERMENTATION PROCESSES AND ITS GENERAL REQUIREMENTS:

An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

UNIT-2

8L+0T+8P=16 Hours

BIOMASS PRODUCTION:

Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics.

Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermochemical degradation. History of small gas producer engine system. Chemistry of gasification

PRACTICES:

- Study of anaerobic fermentation system for industrial application.
- Study of gasification for industrial process heat.
- Study of biomass densification technique (briquetting, pelletization, and cubing)

MODULE-2

UNIT-1

8L+0T+8P=16 Hours

GAS PRODUCER:

Types, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics.

UNIT-2

8L+0T+8P=16 Hours

TRANSESTERIFICATION FOR BIODIESEL PRODUCTION:

A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.



Source:
https://www.devault.org/knowledgebase/case_study/Bio-energy%20to%20Enterprise.png

SKILLS:

- ✓ *Biogas design for small scale farmers.*
- ✓ *Biomass preparation techniques.*

PRACTICES:

- Study of biodiesel production unit.
- Integral bio energy system for industrial application.
- Study of bio energy efficiency in industry and commercial buildings.
- Study and demonstration of energy efficiency in building.
- Measuring efficiency of different insulation technique.
- Study of Brayton, Strirling and Rankine cycles.
- Study of modern greenhouse technologies.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply their knowledge and Understand methods of Cultivation of bio-mass	Apply	1	1, 2, 3, 9
2	Analyze the problems and principle of different types of biomass gasifier	Analyze	1	1, 2, 9, 12
3	Apply and develop new type of models of gasifiers	Apply	2	1, 2, 9, 12

TEXT BOOKS:

1. British BioGen. "Anaerobic digestion of farm and food processing practices"- Good practice guidelines, London, 1997 available on www.britishbiogen.co.uk.

REFERENCE BOOKS:

1. Butler, S "Renewable Energy Academy": Training wood energy professionals, 2005.
2. Centre for biomass energy. "Straw for energy production"; "Technology- Environment-Ecology", 1998. Available: www.ens.dk.