

## Green Fuels & Environmental Technology (2-0-0)

**Sub Code: EE7IXX**

**Hrs / Week: 02**

**SEE Hrs: 2 Hrs**

**CIE : 50 % Marks**

**SEE : 50 % Marks**

**Max. Marks: 50**

### **Course Outcomes:**

**After the successful completion of this course, the student will be able to:**

1. Discuss the relation between humans and environment
2. Describe the green fuel technologies and its impact on environment
3. Apply novel methods for sustainable development

**Module 1: Humans and Environment :** what are we doing, scalability of our habits, are we innovating enough, issues that we are overlooking, what we should be doing, how to manage our waste, pollution and its implications, waste to energy, our innovations are our future.

**8 Hours**

**SLE:** Technologies to dispose e-waste

**Module 2: Green fuels and its significance:** understand fuels, green fuels, alternate energy sources and the cost to future, Novel technologies and the path forward.

**9 Hours**

**SLE:** Innovative ideas to reduce carbon footprint

**Module 3: Protectors of the Earth - Microbes:** understanding microbes and its uses, harmful vs beneficial microbes, using microbes for solving our problems, industrial applications.

**9 Hours**

**SLE:** Technology of bio gas plants

### ***Text Book:***

1. Environmental Technology and Sustainability, 1<sup>st</sup> Edition, by Basanta Kumara Behera and Ram Prasad, Elsevier
2. Removal of Toxic Pollutants through Microbiological and Tertiary Treatment, 1<sup>st</sup> Edition, by Maulin Shah, Elsevier

### ***Reference Books:***

1. Biofuels: Alternative Feedstocks and Conversion Processes By Ashok Pandey, Christian Larroche, Edgard Gnansounou, Academic Press
2. Algal Green Chemistry Recent Progress in Biotechnology, By Rajesh Prasad Rastogi, Datta Madamwar and Ashok Pandey, Elsevier



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AD process can be divided into three stages with three distinct physiological groups of micro-organisms:

- **Stage I:** It involves the fermentative bacteria, which include anaerobic and facultative micro-organisms. Complex organic materials, carbohydrates, proteins and lipids are hydrolyzed and fermented into fatty acids, alcohol, carbon dioxide, hydrogen, ammonia and sulfides.
- **Stage II:** In this stage the acetogenic bacteria (produce acetate by anaerobic respiration) consume these primary products and produce hydrogen, carbon dioxide and acetic acid.
- **Stage III:** It utilizes two distinct types of methanogenic bacteria. The first reduces carbon dioxide to methane, and the second decarboxylates acetic acid to methane and carbon dioxide.

Dr Aswathy is presenting



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### What is energy recovery?

- The process of releasing the energy stored in waste so that it can be utilised either directly or indirectly to generate heat and electricity or biofuels.
- Energy recovery is the process by which solid waste is converted into feedstock materials or renewable energy.

Dr Aswathy is presenting

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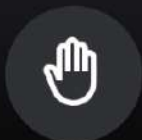
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**Waste hierarchy**

Waste hierarchy refers to 3 Rs  
Reduce, Reuse, Recycle

The diagram shows a pyramid with six horizontal layers. From top to bottom, the layers are labeled: prevention, minimisation, reuse, recycling, energy recovery, and disposal. To the left of the pyramid is a vertical double-headed arrow. The top half of the arrow is green and labeled 'most favoured option', while the bottom half is red and labeled 'least favoured option'.

Dr Aswathy is presenting



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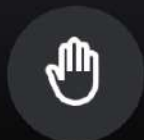
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### WHAT SHOULD BE DONE

• **Reduce Waste**

- Reduce office paper waste by implementing a formal policy to duplex all draft reports and by making training manuals and personnel information available electronically.
- Improve product design to use less materials.
- Redesign packaging to eliminate excess material while maintaining strength.
- Work with customers to design and implement a packaging return program.
- Switch to reusable transport containers.
- Purchase products in bulk.

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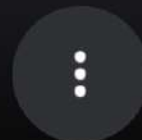
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**SOURCES OF HUMAN EXPOSURES**

Exposures occurs through

- Ingestion of contaminated water or food
- Contact with disease vectors
  - Inhalation
  - Dermal

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