Practical Manual

on

Renewable Energy & Green Technology

AAE 235 - 2 (1+1)

B.Sc. (Hons.) Agriculture, IV semester

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2020

College of Agriculture,
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Syllabus AAE 235 – 2 (1+1)

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

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CONTENTS

Experiment No. 1

Objective: To familiarize with renewable energy gadgets.

Renewable Energy: ----------

Various forms of renewable energy

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

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6. ---

Experiment No. 2

Objective: To study solar radiation and its measurement.

Nature of solar radiation: ----------

Solar constant: ----------

Factors affecting solar constant and extra-terrestrial radiation:

Distance between the earth and sun: ----------

Radiation emitted by the sun: ----------

Solar radiation on earth's surface

Beam radiation: ----------

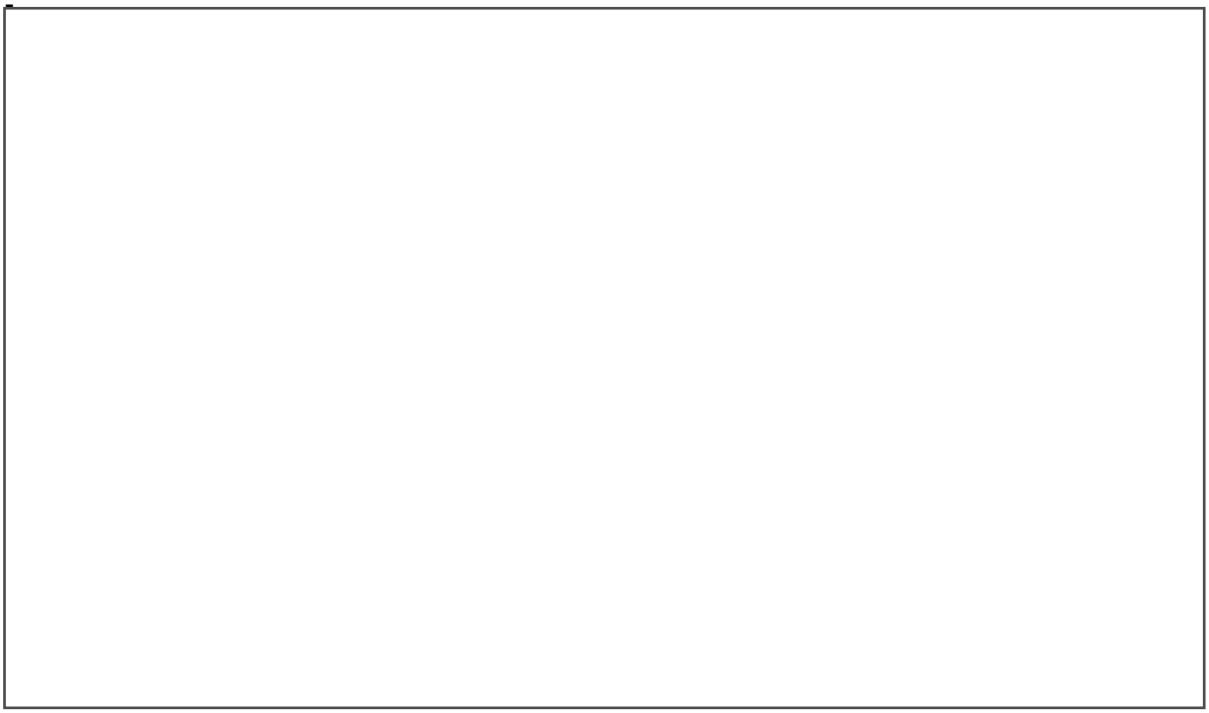
Diffused radiation: ----------

Extra-terrestrial radiation: ----------

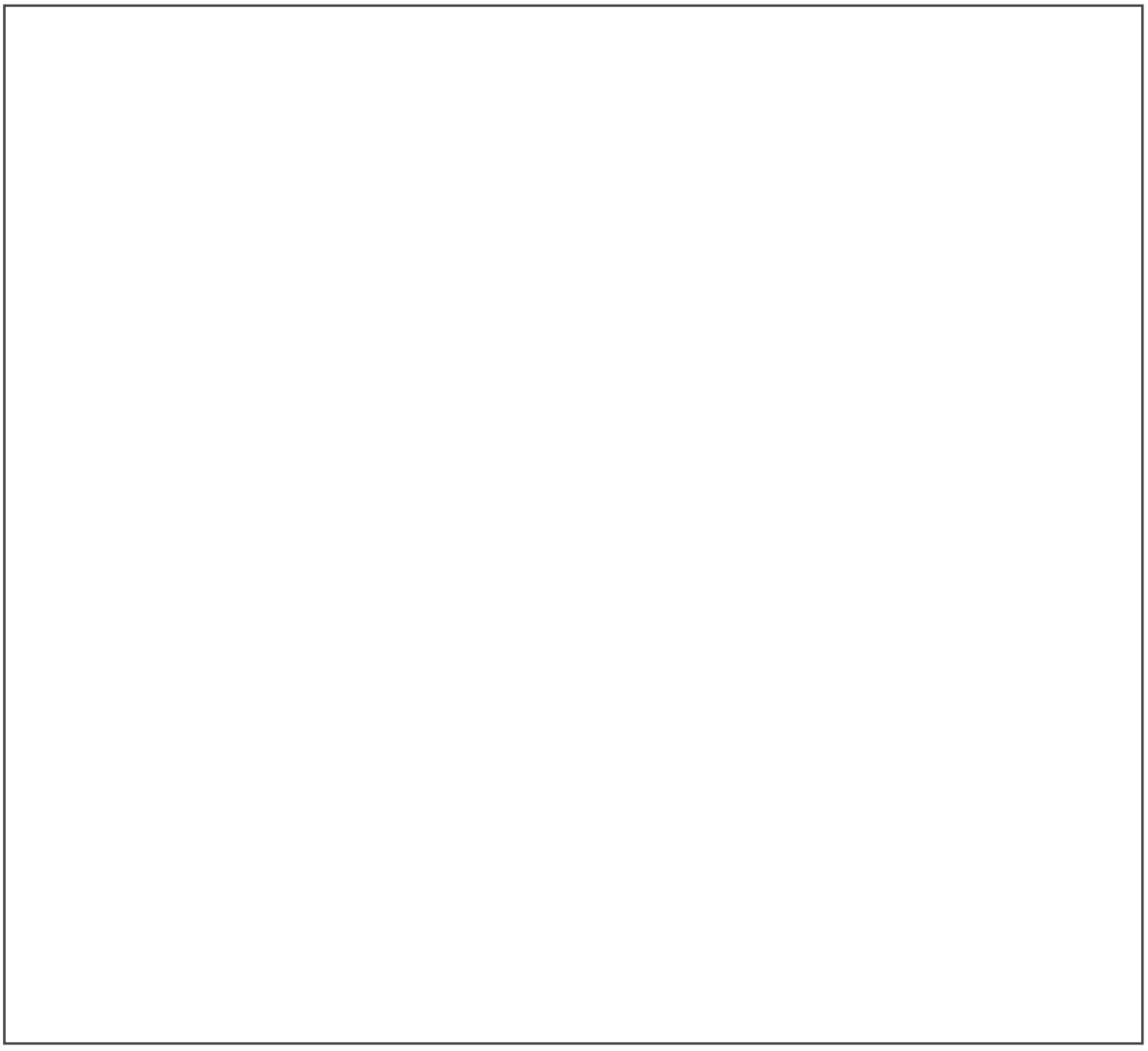
Global or total radiation: ----------

Solar Radiation Measurement:

Pyrheliometer: ----------



Pyranometer: ----------



Experiment No. 3

Objective: To study working and principle of biogas plants.

Biogas: ----------

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Composition of bio-gas:

S. No.	Gas	Amount (%)

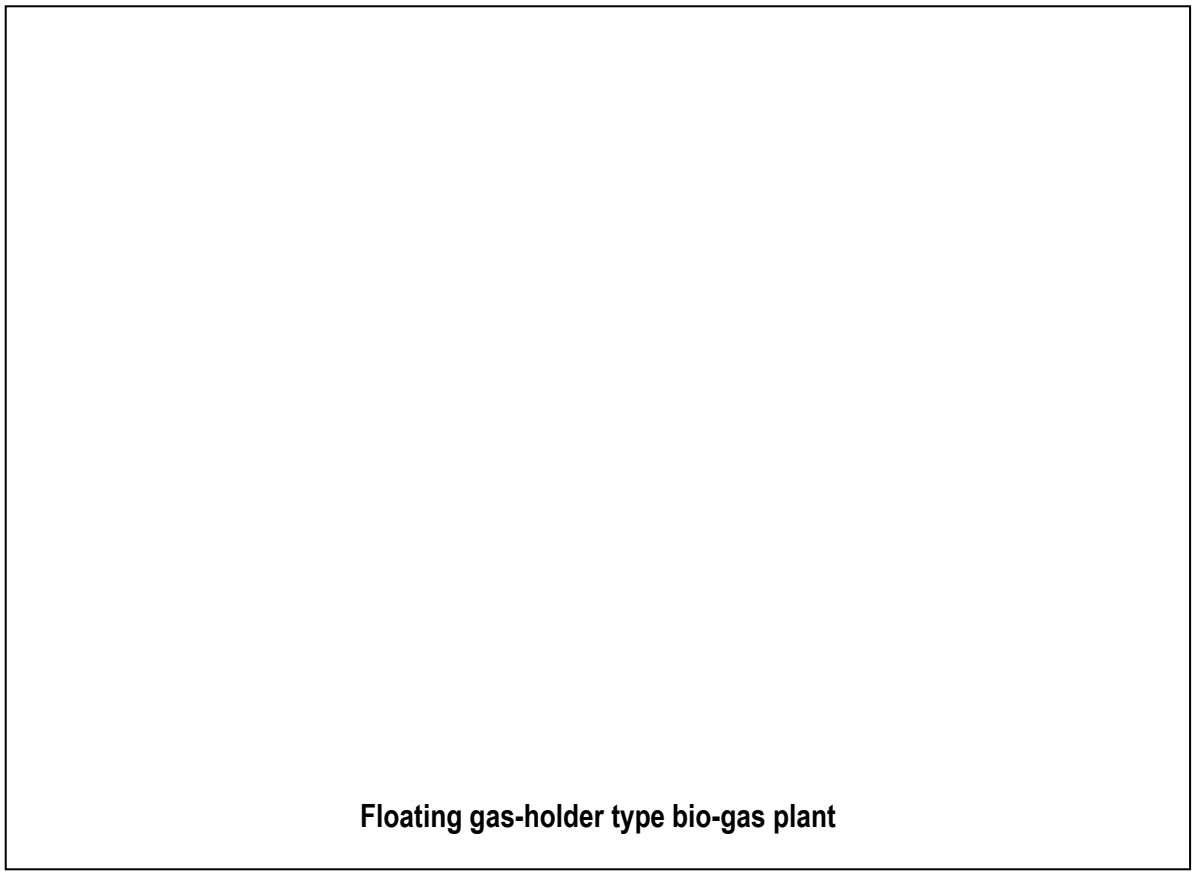
Comparison of bio-gas with other fuels

S. No.	Name of fuel & Unit	Calorific value (Kcal)	Mode of burning

Biogas plants: ----------

Floating gas-holder type bio-gas plant

Construction: ----------



Floating gas-holder type bio-gas plant

Working principle: ----------

Advantages: ----------

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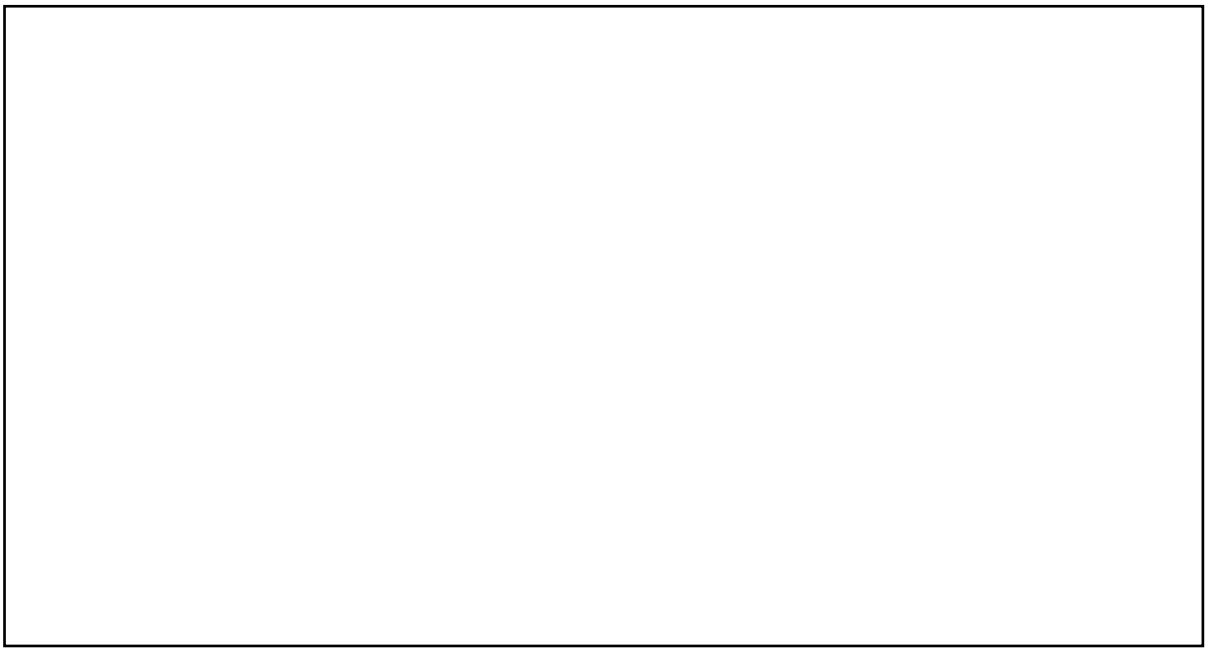
Disadvantages: ----------

Fixed dome (constant volume) type bio-gas plant

Construction: ----------



Working principle: ----------

Advantages: ----------

-

Disadvantages: ----------

Classification of fixed type and floating drum type bio-gas plant

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Deenbandhu model: ----------

Deenbandhu Model

KVIC model: ----------

Drawbacks of KVIC model: ----------

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Janta model: ----------

Selection of site for a bio-gas plant

Factors affecting bio-digestion or generation of gas

Experiment No. 4

Objective: To design a community biogas plant.

Problem: A village consisting of 98 families, each family consisting of 5 persons (adults). Two children are equivalent to one person. Village survey report gives the following information about cattle.

Cattle	No.
Cows	102
Oxes	124
Buffalo	52
Pig	03

A community biogas plant is to be designed only for cooking and house lighting. Each family is allotted 2 lamps, which would burn 2 hours daily.

Solution: ----------

Experiment No. 5

Objective: To study about different gasifiers used in thermal gasification of biomass.

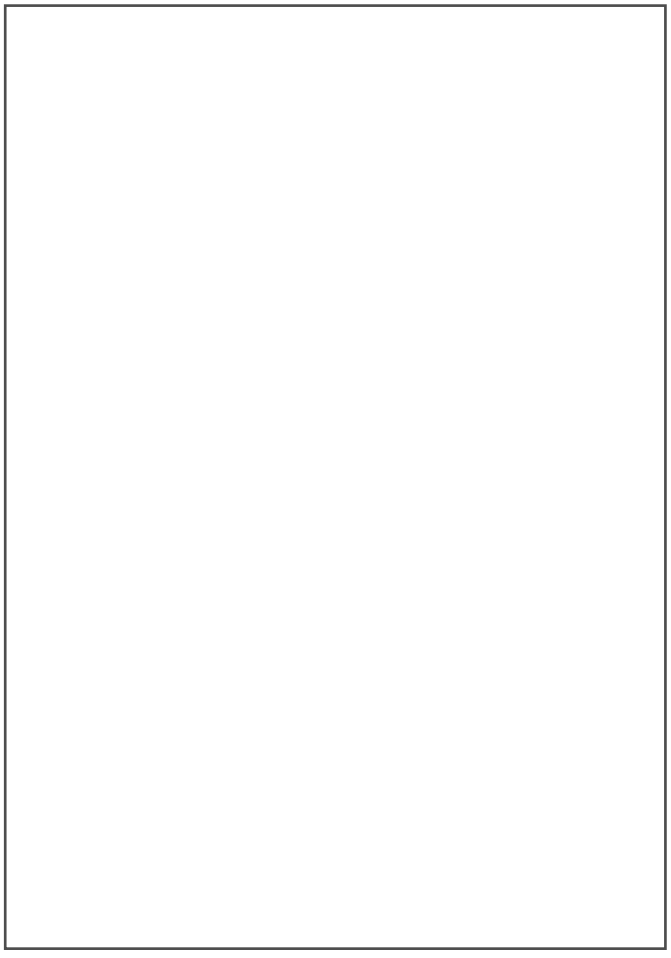
Biomass gasification: ----------

Gasification reactions: ----------

Classification of biomass gasifiers:

Fixed bed gasifiers:

Updraft gasifier: ----------



Downdraft gasifier:

Cross-draft gasifier:

Fluidised bed gasifier: ----------

Advantages: ----------

Experiment No. 6

Objective: To study the production process of biodiesel.

Bio-diesel: ----------

Feedstocks Used in Biodiesel Production: ----------

Typical proportions for the chemicals used to make biodiesel are:

Reactants	Catalyst	Analyzer

Advantages of the use of biodiesel:

Disadvantages of the use of bio-diesel: ----------

Experiment No. 7

Objective: To study biomass briquetting.

Biomass briquetting or briquetting technology:

Methods of briquetting: ----------

Classification of briquetting machine: ----------

Manually operated briquetting machine: ----------

Animal operated briquetting machine: ----------

Power operated briquetting machine: ----------

Piston-ram press type: ----------

Screw-press type: ----------

Pellet-press type: ----------

Agro-waste compaction machine: ----------

Experiment No. 8

Objective: To study production process of bio-fuels.

Bio-fuel: ----------

Production of Ethanol: ----------

Concentrated Acid Hydrolysis Process: ----------

Dilute Acid Hydrolysis Process: ----------

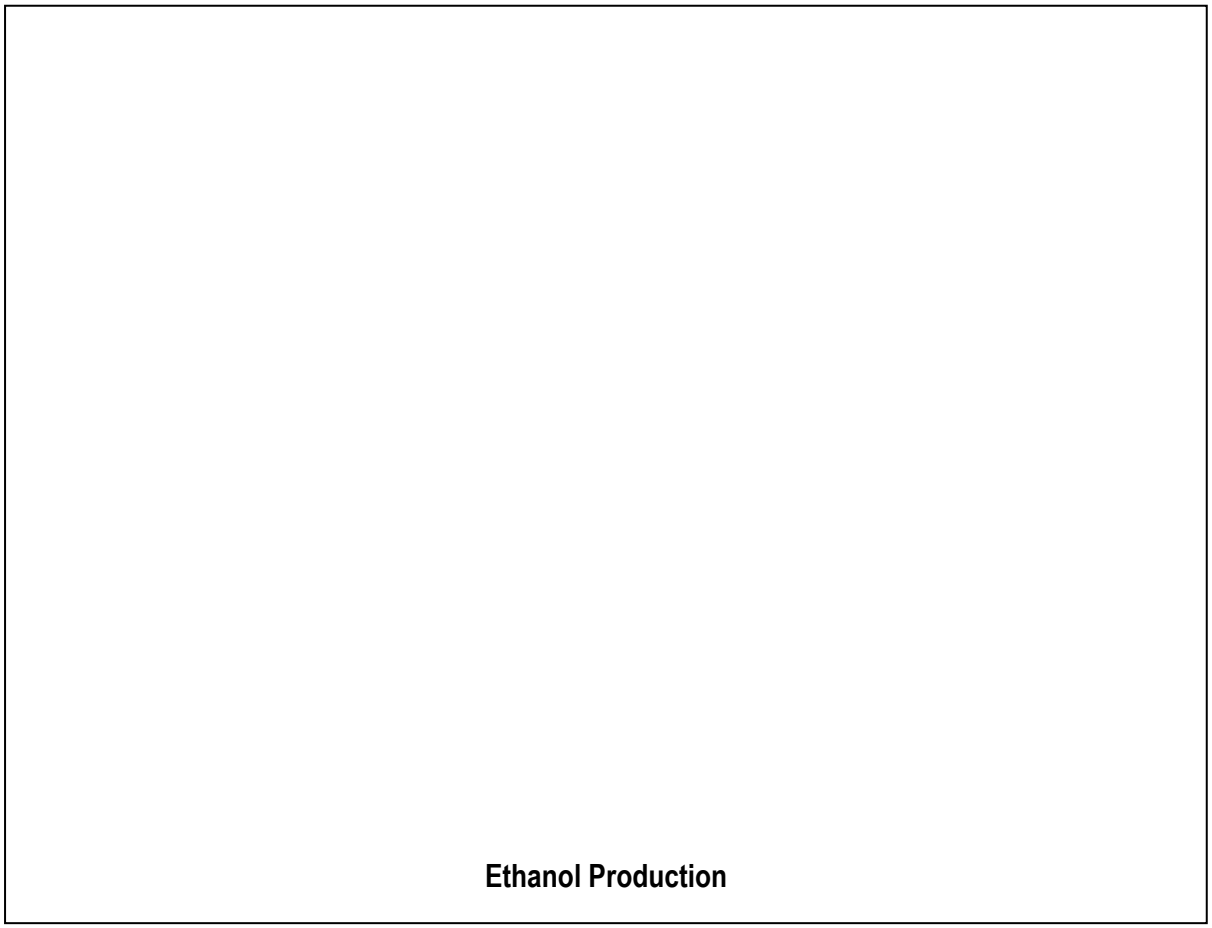
Enzymatic Hydrolysis: ----------

Wet Milling Processes: ----------

Dry Milling Process: ----------

Sugar Fermentation Process: ----------

Fractional Distillation/Separation Process: ----------



Ethanol Production

Experiment No. 9

Objective: **To familiarize with different solar energy gadgets.**

Solar energy: ----------

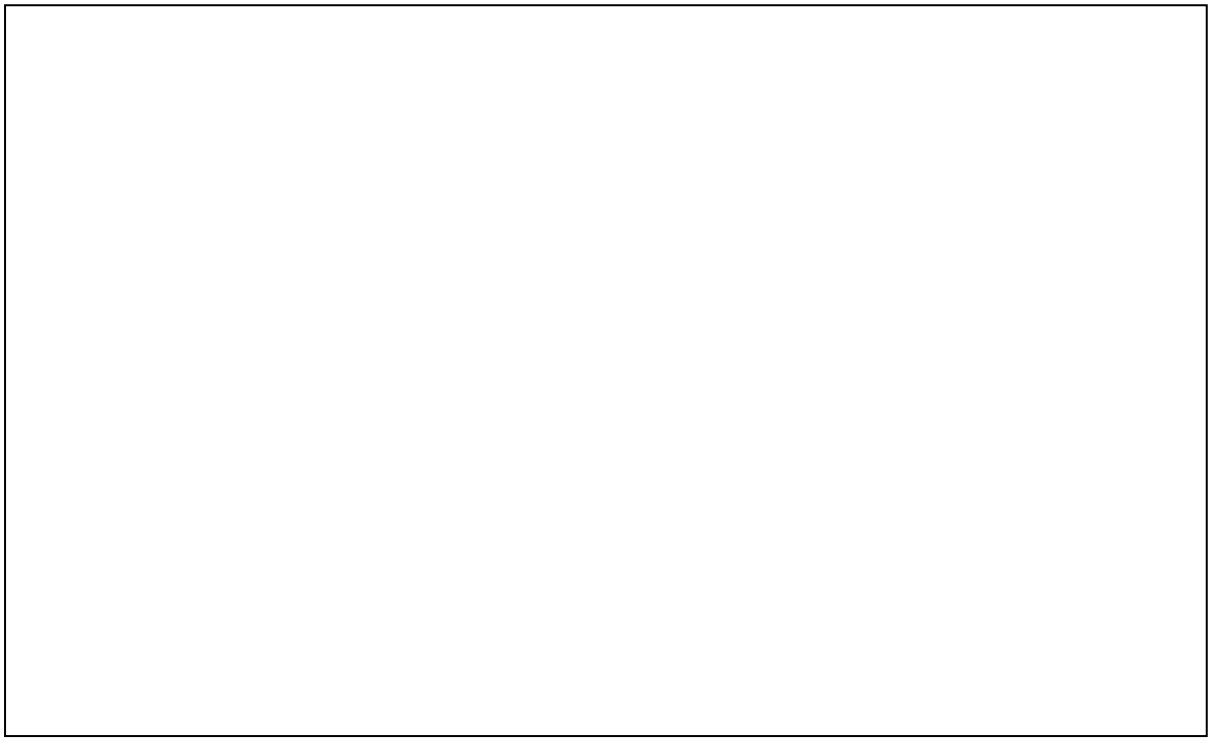
Solar energy gadgets:

Solar water heater: ----------

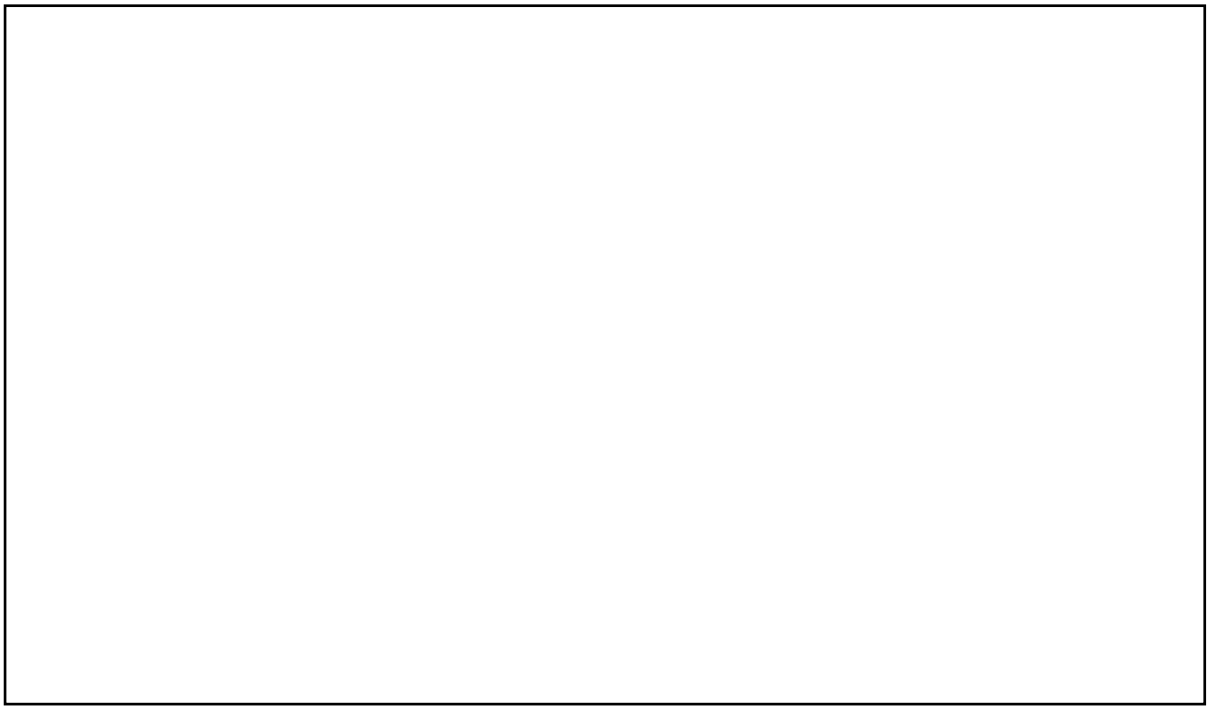
Space heating: ----------

Space cooling: ----------

Solar distillation: ----------



Solar pumping: ----------



Solar pond: ----------

Experiment No. 10

Objective: To study solar photovoltaic system and their application.

Solar PV system: : ----------

Photovoltaic effect: : ----------

Solar cell characteristics: : ----------

Classification of solar cell:

On the basis of thickness of active material: ----------

On the basis of type of junction structure: ----------

On the basis of type of active material: ----------

Solar PV panel: : ----------

Usage of solar PV energy: : ----------

Experiment No. 11

Objective: To study principle and working of solar cooker.

Solar cooking: ----------

Designs of solar cooker:

Box type solar cooker:

Principle: ----------

Working: ----------

Details of a box type solar cooker

Advantages of solar cooker: ---

Limitations of solar cooker: ---

Experiment No. 12

Objective: To study working of solar lights.

Solar lantern: ----------

Solar street lights: ----------

Experiment No. 13

Objective: **To study working of solar pumping.**

Solar water pump: ----------

Basic components of a system: ----------

Applications of solar water pump: ----------

Advantages of solar water pump: ----------

Disadvantages of solar water pump: ----------

Experiment No. 14

Objective: **To study working of solar power fencing.**

Solar power fencing technology: ----------

Working of solar power fencing technology: ----------

Components of solar power fencing: ----------

Advantages: ----------

Disadvantages: ---

Experiment No. 15

Objective: **To study solar energy and its use in solar drying system.**

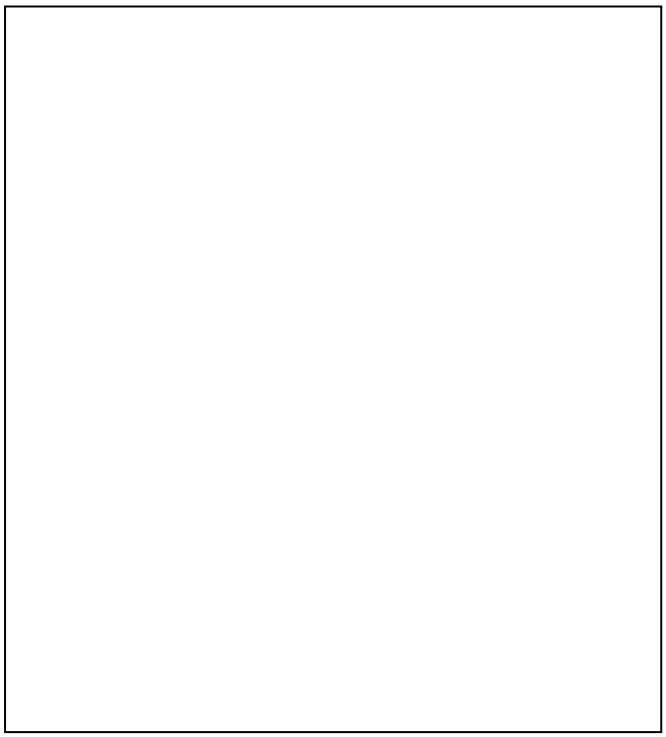
Solar energy: ----------

Solar dryer: ----------

Cabinet type solar dryer: ----------

Suitability: ----------

Convection type dryer: ----------



Suitability: ----------

Advantages: ----------

Limitations of solar dryer: ----------

Experiment No. 16

Objective: To study the importance of solar distillation system in arid, semi-arid and coastal areas.

Solar distillation: ----------

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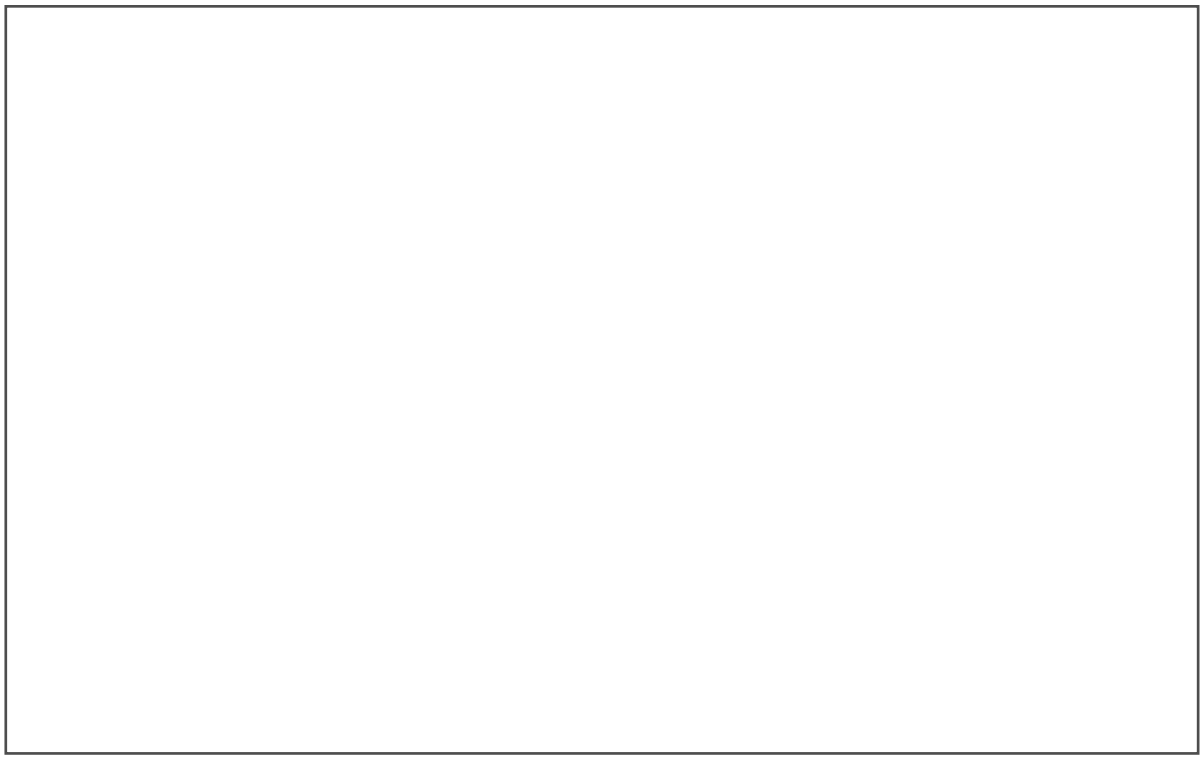

Principle: ----------

Energy requirement for water distillation: ----------

Experiment No. 17

Objective: To study solar pond used for collecting and absorbing solar radiation energy.

Solar Pond: ----------

Principle and operation and description of non-convective solar pond: ----------

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Zones of Solar Pond: : ----------

Characteristics of salt for creating density gradient in solar pond: ----------

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Applications of solar pond:

Objective: To study wind energy conversion system.

Wind energy: ----------

Basic principles of wind energy conversion:

The Nature of the wind: ----------

The Power in the wind: ----------

Forces on the blades and thrust on turbines: ----------

Dependence of wind rotor power on wind speed and rotor diameter

---

Wind energy conversion: ----------

Site selection considerations: ----------

Basic components of a WECS: ----------

Applications and limitations of wind energy: ----------

Advantages and disadvantages of wind energy: ----------

Solar constant: It is the rate at which energy is received from the sun on unit area perpendicular to direction of the sun at a mean distance of the earth from the sun. It is mathematically expressed as-

$$= I_{sc}\left[1 + 0.033\cos\frac{360n}{365}\right] ; \text{Wm}^{-2}$$

Where n = No. of days counted from 1st January

I_{sc} = Solar constant

Average value of excreta:

Cows	10 kg per day
Oxes	12 kg per day
Buffalo	15 kg per day
Calves	5 kg per day
Horses	10 kg per day
Goat/Sheep	5 kg per day
Pigs	2 kg per day
Chicken	0.18 kg per day
Human excreta per person	0.40 kg per day

- Gas required for cooking/person/day = 0.227 m^3
- Gas required for lighting 100 C.P. lamp per hour = 0.126 m^3

Fuel properties of bio-gas

Composition	% Volume
Methane	50-60
Carbon dioxide	30-45
Hydrogen	5-10
Nitrogen	0.5-0.7
Hydrogen sulphide and oxygen	Traces