#### **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, Rani Lakshmi Bai Central Agricultural University Jhansi - 284003

#### 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 biofuels. 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**

S. No.	Name of Exercise	Page No.
1.	To familiarize with renewable energy gadgets	
2.	To study solar radiation and its measurement	
3.	To study working and principle of biogas plants	
4.	To design a community biogas plant	
5.	To study about different gasifiers used in thermal gasification of biomass	
6.	To study the production process of biodiesel	
7.	To study biomass briquetting	
8.	To study production process of bio-fuels	
9.	To familiarize with different solar energy gadgets	
10.	To study solar photovoltaic system and their application	
11.	To study principle and working of solar cooker	
12.	To study working of solar lights	
13.	To study working of solar pumping	
14.	To study working of solar power fencing	
15.	To study solar energy and its use in solar drying system	
16.	To study the importance of solar distillation system in arid, semi-arid and coastal areas	
17.	To study solar pond used for collecting and absorbing solar radiation energy	
18.	To study wind energy conversion system	

	Objective: To familiarize with renewable energy gadgets.  Renewable Energy:				
Var	ious forms of renewable energy				
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6.	

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
Ocial faciation on earth 5 surface
Beam radiation:

Diffused radiation:
Extra-terrestrial radiation:
Global or total radiation:
Solar Radiation Measurement:
Pyrheliometer:

Pyranometer:	

	io study working and princi	ple of biogas plants.	•
iogas:			
Composition	of bio-gas:		
6. No.	Gas		Amount (%)
I			
Comparison o	of bio-gas with other fuels		
S.	of bio-gas with other fuels  Name of fuel & Unit	Calorific value (Kcal)	Mode of burning
<b>S</b> .		Calorific value (Kcal)	Mode of burning
<b>S</b> .			Mode of burning
S.			Mode of burning
<b>S</b> .			Mode of burning
<b>S</b> .			Mode of burning
Comparison of S. lo.			Mode of burning
<b>S</b> .			Mode of burning

oating gas-hold	er type b	io-gas pl	ant				
onstruction:							 
		Floatin	g gas-hole	der type b	io-gas pl	ant	
orking principle							
nking principle							 

\dvantage:	
Auvaniayes	
N. 1 (	
Jisadvantages:	
Eixed dome (constar	nt volume) type bio-gas plant
Construction:	
	·

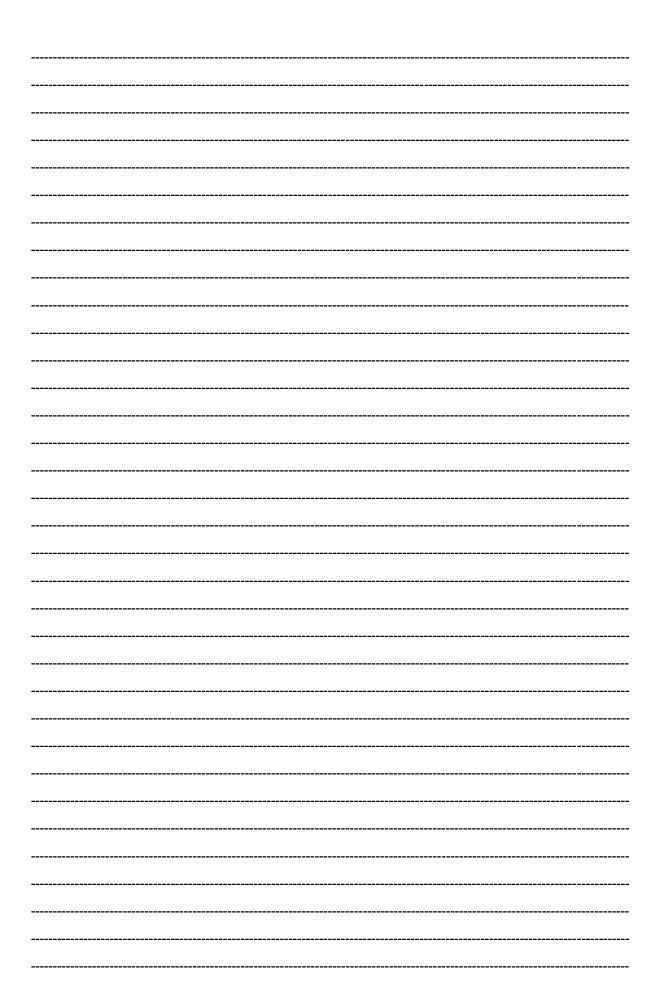
Working principle:	
Advantagas	
Advantages:	
-	
Disadvantages:	
Disadvantages:	
Classification of fixed type and floating drum type bio-gas plant	
eracement of the area type and treatmy areas type are gas prain-	
Deenbandhu model:	

Deenbandhu Model	
KVIC model:	
	<b></b>

- · · · · · · · · · · · · · · · · · · ·	
Drawbacks of KVIC model:	
-	
Janta model:	
Selection of site for a bio-gas plant	

Factors affecting bio-digestion or generation of gas	
r dotors directing bio digestion or generation or gus	
·	

			Experiment No
bjective: To desi	gn a community biogas រុ	olant.	
	sisting of 98 families, each far nt to one person. Village sur		
Callie.	Cattle	No.	
	Cows	102	
	Oxes	124	
	Buffalo	52	
	Pig	03	
	urn 2 hours daily. 		
			ng. Each family is allotte




Objective:	To stud biomass		different	gasifiers	used	in	thermal	gasification	O
Biomass gas	sification: -								
_									
Gasification									
Classificatio	n of hioma	ss nasifier	e.						
Olassilicatio	ii oi bioilla								
					<b></b>				

Fixed bed gasifiers:	
Updraft gasifier:	

Downdraft gasifier:	
Cross-draft gasifier:	
oross-uran gasiner.	

Fluidised bed gasifier:Fluidised bed gasifier:
Advantages:
<b></b>

		Experiment No.
-	production process of biodiese	el.
Bio-diesel:		
eedstocks Used in Biodie	sel Production:	
vnical proportions for the	chemicals used to make hiodiesel ar	
ypical proportions for the Reactants	chemicals used to make biodiesel ar	re: Analyzer
Reactants	Catalyst	
	Catalyst	
Reactants	Catalyst	
Reactants	Catalyst	

	Experiment No. 7
Objective: To study biomass briquetting.	
Biomass briquetting or briquetting technology:	
Methods of briquetting:	

Manually operated briquetting machine:	
Animal operated briquetting machine:	
Power operated briquetting machine:	
Piston-ram press type:	

Screw-press type:	 	 	
ociew-piess type.			
Pellet-press type:		 	
Tellet press type.			

Agro-waste compaction machine:

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	

Objective: To familiarize with different solar energy gadgets.
Solar energy:
Solar energy gadgets:
Solar water heater:
Space heating:
Space cooling:

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Solar distillation: -	 	 	

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Solar pumping:	 			
Solar pond:	 			
ooiai poliu.				
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	Experiment No. 10
Objective: To study solar photovoltaic system and their app	-
Solar PV system: :	
Dhatavaltaia affacti i	
Photovoltaic effect: :	
Solar cell characteristics: :	

Classification of solar cell:
On the basis of thickness of active material:
on the basis of this knows of active material.
On the basis of type of junction structure:
On the basis of type of junction structure.
On the basis of type of active metarials
On the basis of type of active material:
Solar PV panel: :

Usage of solar PV energy: :	
30.00	

Objective: To study principle and working of solar cooker.
Solar cooking:
Designs of solar cooker:
Box type solar cooker:
Principle:
Warting
Working:

	Details of a box type solar cooker	
Advantages of solar cookers		
Advantages of solar cooker:	Details of a box type solar cooker	
Advantages of solar cooker:		

Objective: To study working of sola	ar lights.
Solar lantern:	
Solar street lights:	

Objective: To study wor Solar water pump:		
Basic components of a syst	em:	 

Applications of solar water pump:	
Advantages of solar water pump:	
Disadventages of colon water number	
Disadvantages of solar water pump:	

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:
Disauvantayes.

Objective: To study solar energy and	d its use in solar drying system.
Solar energy:	
ooiai uryer.	
Cabinet type solar dryer:	

Suitability:	
	Convection type dryer:
Suitability:	
Advantages	
Advantages:	
Limitations of solar dryer:	

	Experiment No. 1
Objective:	To study the importance of solar distillation system in arid, semi-ariand coastal areas.
Solar distilla	ation:

Principle:	
 Energy requirement for water distillation:	
 Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	
Energy requirement for water distillation:	

Objective:	jective: To study solar pond used for collecting and absorbing solar radiatio energy.		
Solar Pond:			
Principle an	d operation and description of non-convective solar pond:		
	· 		

7 of Color Dond.	
Zones of Solar Pond: :	
Characteristics of salt for creating density gradient in solar pond:	
Applications of solar panels	
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 Nature of the wind:				
The Power in the wind:				

orces on th	e blades and thrust on turbines	······································		
	Dependence of wind rotor po	wer on wind spee	d and rotor diameter	

Wind energy conversion:			 
Site selection considerations: -			 
B 1 / 4 11 mag			
Basic components of a WECS:			 
	<b></b>	<b>_</b> _	 <b>-</b>

Applications an	d limitations of wind ene	·gy:
<b>A.</b> 1		
Advantages and	d disadvantages of wind e	energy:
Advantages and	d disadvantages of wind e	energy:
Advantages and	d disadvantages of wind e	energy:
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Advantages and	d disadvantages of wind e	energy:
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**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-

= 
$$I_{sc} \left[ 1 + 0.033 \cos \frac{360n}{365} \right]$$
; Wm<sup>-2</sup>

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

I<sub>sc</sub> = 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 m³
- ❖ Gas required for lighting 100 C.P. lamp per hour = 0.126 m³

#### 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